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International Political Effects Of the Spread of Nuclear Weapons

Edited by
John Kerry King

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The essays in this publication were written for a colloquium organized to consider the potential international political consequences if the number of states possessing nuclear weapons increases significantly during the next 10 to 15 years.

The colloquium was sponsored by the National Foreign Assessments Center, Central Intelligence Agency, and by the Office of the Assistant Secretary of Defense for International Security Affairs.

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FOREWORD

Technical and economic considerations no longer prevent the acquisition of nuclear weapons by nations that do not have them. The technology is now widely known and generally accessible, and the cost is not prohibitive. For an increasing number of nations a decision to develop nuclear weapons rests on political and strategic factors.

An important, high priority aspect of United States foreign policy is to stop, or to curtail, tendencies toward the spread of nuclear weapons and of weapons-related technology. However optimistic the outlook for that policy—and there are reasons for optimism—the potential consequences of continued proliferation can be very significant and, therefore, are worthy of serious discussion, even though the analysis may include considerable speculation.

A spread of nuclear weapons would appear likely to alter the political interests and attitudes of many nations, and to change, perhaps dramatically, the international political environment in which United States foreign policy would have to function. For example: the number and diversity of countries and situations of strategic concern would be multiplied; the potential destructiveness of relatively limited regional wars would be increased; the requirements for defense, for security, and for alliance strategy would be reviewed by many nations; and fundamental concepts of international relations could be affected.

There is an extensive literature on the scientific and technological aspects of nuclear weapons development, on the relationship between weapons development and nuclear energy, on the economic trade-off between nuclear and other forms of energy, and on various strategies to discourage or to prevent the development of nuclear weapons by, or their spread to, nations that do not have them. Comparatively little research and analysis has been done on the potential political consequences if further nuclear weapons proliferation does in fact happen. Although there are some outstanding exceptions, the literature on the "what if" aspects of the subject is not extensive or comprehensive.

The colloquium for which this series of essays was written was planned as a step toward closing that gap and as a means of stimulating additional work on the subject by government and academic researchers and analysts. The colloquium was unclassified, and it was conceived as a multi-disciplinary, speculative inquiry into the nature and dynamics of international relations in a future world in which the possession of nuclear weapons had spread significantly. The assumed time was about 1995.

Knowledgeable and creative thinkers from differing disciplines and backgrounds were invited to write original essays on various aspects of a future international political scene. All used as their starting point a series of broad assumptions concerning the spread of nuclear weapons, set in the context of several other international issues. The statement of assumptions provided the essayists was as follows:

"The essays prepared for this colloquium and the ensuing discussions are based on the assumption that, despite the best efforts of the United States and other nations, the trend toward the spread of nuclear weapons and nuclear technology will gain momentum during the next decade. Because the nuclear situation cannot stand in isolation, several broad assumptions concerning other significant and likely global developments also are offered. The assumptions are intended as a common starting point and general guide for the essayists and the conference discussion, not foregone conclusions concerning the future nor boundary lines limiting speculation or analysis. Some may want to alter or to add to the assumptions provided, and they are invited to do so.

"The 1980s are likely to be a trying decade for the United States. It appears that the world will become an increasingly complex and stressful setting for the pursuit of United States policy objectives and increasingly resistant to unilateral United States efforts at problem solving. Domestic political weaknesses and economic difficulties in at least half the nations of the world seem likely to exert higher degrees of pressure for short-term, nationalistic responses to urgent resource, economic, and security problems that can be solved, if at all, only by multinational efforts. Frictions between the less developed and the industrial states will probably intensify as global economic problems stimulate the demands of the former and limit the capability or willingness of the latter to respond.

"Four present international issues of special significance are likely to continue to exacerbate national and international political affairs during the 1980s, and they will be sources of increasingly acute tension:

1. The world energy situation probably will be more critical. Fossil fuels will be expensive and in some instances scarce; energy demand will be higher than today, although the rate of increase may slow; and alternate follow-on energy systems will not yet be available.

2. The pressure of expanding population on available food supplies seems certain to intensify. We assume no technological breakthrough with respect to food production, no significant change in the world distribution system, and no sociological turnaround with respect to population control.

3. The gap between the rich and the poor nations, the industrial and the non-industrialized, will widen; however, a small number of the so-called middle tier states are likely to make substantial economic progress.

4. Terrorism will probably intensify and spread. The economic, political, and sociological conditions that spawn it, and the complex psychological motivations that energize it, are not likely to ameliorate during the decade.

"During the decade of the 1990s a large number of nuclear reactors will be in operation around the world. They will be present on all continents, and at least 50 countries will have the capability to develop nuclear weapons. For the purposes of this colloquium, we assume that more than a dozen of them of varying motivations and capabilities will have developed or otherwise acquired a nuclear weapons capability. Many others will be able to do so in a brief period. The following nations are among those likely to have the capability and some degree of motivation to acquire nuclear weapons: Argentina, Brazil, Iran, Israel, Egypt, Iraq, Japan, South Korea, Taiwan, Spain, West Germany, Yugoslavia, India, Pakistan, Libya, South Africa, Greece, and Turkey.

"Despite the spread of nuclear weapons, we assume that a sense of military 'balance' between the United States and the Soviet Union will continue and that their nuclear power will overshadow that of all others."

The colloquium brought together 50 people from the academic, research organization, intelligence, and national security policymaking communities for three days in October 1978, to discuss the essays and the questions generated by them. The emphasis throughout was on attempting to describe and analyze the international political environment under the assumed circumstances. The colloquium plan did not contemplate reaching a consensus on the many issues that emerged or arriving at an agreed set of conclusions. Rather, it was intended to stimulate thought and to assist in planning future research and analysis.

After the colloquium the authors were given a month in which to make any revisions they desired in their manuscripts. The essays stand on their own as the work of the individual authors. They have been published and made available because they may be of general interest and may stimulate further work on the subject.

John Kerry King
Colloquium Coordinator
February 1979
Menlo Park, California

THE DEVELOPMENT AND DEPLOYMENT OF NUCLEAR WEAPONS SYSTEMS IN A PROLIFERATING WORLD

Gene I. Rochlin
Institute of Governmental Studies
University of California, Berkeley

ABSTRACT

Osric: The King, sir, hath wagered with him six Barbary horses, against which he has imponed, as I take it, six French rapiers and poniards, with their very assigns, as girdle, hanger, and so—three of the carriages, in faith, are very dear to fancy, very responsive to the hilts, most delicate carriages, and of very liberal conceit.

Hamlet: What call you the carriages?

Horatio: I knew he must be edified by the margent * ere you had done.

Osric: The carriages, sir, are the hangers.

Hamlet: The phrase would be more germane to the matter if we could carry a cannon by our sides. I would it might be hangers until then...

Wm. Shakespeare: Hamlet; Act V, scene ii.

The high-flown language of Osric is harmless parody of the courtiers of Shakespeare's time. The difficulties faced by present-day arms control analysts in dealing with persistent oversimplification in description of potential weapons capabilities are more serious. A nuclear explosive is not necessarily usable as a weapon. To perform a military as well as a diplomatic role, a nuclear explosive device must be designed and constructed so that potential users will have confidence in its performance, and mated to a means for delivery to a potential target appropriate to its predicated role.

Many states now have or will acquire in the next decade or so the technical ability to successfully construct and detonate a nuclear device. Moreover, the state of scientific and technical knowledge related to the design of nuclear explosives is much advanced over that of the 1940s and 1950s, and it is to be expected that these states will be able rather quickly to acquire relatively compact and deliverable designs. Although large and diverse arsenals such as that of the US will probably be beyond the technical and economic capabilities of many, once the decision to opt for nuclear weapons is taken, and the requisite resources are committed, inventories should rapidly push into the dozens or hundreds.

* Margent = margin, e.g., footnotes in modern usage.

Delivery systems are more difficult to analyze, for what constitutes a usable delivery system depends upon the mission and opponent selected. Few states will be able to pose a credible military threat to superpowers, although the threat of clandestine or subversive use cannot be discounted. Credible systems for use against similarly armed and located opponents, a far more probable scenario, will be simpler to acquire. The present situation with regard to exports of aircraft and other potential delivery systems places few limitations, other than economic, on the ability to wage local nuclear warfare.

At the moment, potential use is somewhat restricted by the survivability of expensive and scarce offensive systems in a highly developed defensive milieu. However, continued export of high-performance aircraft capable of carrying medium-range, actively powered and guided air-to-surface missiles, and the prospective development of far less expensive remotely and self-controlled pilotless vehicles (e.g., cruise missiles) could make credible delivery systems available to a wide range of states in the 1990s.

Unless there is a major shift in current military development and export policies, technical and economic barriers to the development or acquisition of battle-usable nuclear weapons systems are therefore expected to decrease steadily through the next two decades.

I. INTRODUCTION

"Nuclear proliferation" is often used as a shorthand to describe the alteration in the configuration of military and political relations among states when a single variable alters—the detonation by a state of its first nuclear explosion. The technical possibilities for proliferation so defined are relatively easy to set out. But to discuss the technical setting of nuclear weapons proliferation in the 1990s presumes an adequate definition of what is a nuclear weapon and what is a delivery system. This is not easily arrived at. To ask what might be the military uses of nuclear weapons and how they might be delivered to a prospective target requires specification of intended and perceived military and political purpose to a degree of precision that may not be matched by the actors themselves. If many small weapons are available, a state may be led to contemplate more extensive battlefield use of such weapons.[1] Conversely, if battlefield weapons are sought, stringent conditions are imposed upon weapons and delivery system design.

Not all nuclear explosives, even when intended for non-peaceful purposes, are properly termed weapons. A weapon, formally defined, is an instrument of combat—something with which to fight in battle—ranging from a rock to a rocket. In this sense, the Hiroshima and Nagasaki bombs were not weapons but instruments primarily of terror. Their aim was to weaken the political rather than the military strength of Japan.[2] For many years after, the U.S. nuclear arsenal was used more for diplomatic than war-fighting purposes—first to intimidate, then to reassert pre-war power relations and establish new ones, then to deter. Only within the NATO-WTO context has the public debate broadened to include the use of nuclear weaponry designed specifically for battlefield use.[3] Even so, there remains considerable argument over the risk of crossing the "nuclear firebreak" and conventionalizing nuclear weapons use.

Entertaining such debate, however, is a luxury reserved to the superpowers, which possess abundant supplies of weapons material, sophisticated device design teams, high-technology missile and aircraft industries, and the ability to produce complete weapon-delivery systems in great quantity and variety. Smaller states cannot afford to develop a different warhead for every purpose or potential target, nor delivery systems designed to survive in a wide variety of hostile environments.

These states may seek only enough capability for diplomatic and political gain. They may be capable of producing only systems sufficient for use as instruments of terror, or the threat of terror. Or they may seek sufficient capability for credible use in combat over a limited range of possible conflicts. In each case, the determining technical and economic factors will be different. Technical possibilities must take into account intent, purpose, military and diplomatic milieu, economic and technical resource limitations, and mission. Only within this context can preferences and purposes be compared with abilities.

II. PREFERENCE AND PURPOSE

Defining an "event" of nuclear proliferation as the detonation of a nuclear explosive device is politically convenient, for it responds to an unambiguous act. The presumption is that only intent is then lacking for the development of a weapon. By modern standards, however, this historically convenient demarcation is blurred. The continued spread of nuclear materials, technologies, equipment, and trained personnel accompanying the worldwide development of commercial nuclear power, and the attendant increase in the generally achievable level of sophistication and information, increasingly leads to a condition that has been characterized as "latent" proliferation.[4] By the 1990s there will be dozens of states that must be presumed capable of building a nuclear explosive using only indigenous capabilities if they will to do so.[5] One is hard-pressed to judge whether India, which has tested, or Israel, which has not, could make the more credible weapons threat. Moreover, should a general nuclear armament race begin, there is no question that states such as the FRG, Japan, and Sweden could arm in large numbers far more rapidly than India, Israel, or Taiwan.

Many states are already judged to be capable of building usable nuclear weapons; by the 1990s there will be anywhere from a dozen to two dozen more.[6] Whether these states will feel constrained to openly acknowledge their programs by testing is not certain. This may appear irrelevant to our discussion here, since we are instructed to assume that, in a period beginning in 1990, a dozen or more states of various size and capabilities will have or be developing deliverable, usable weapons. Nevertheless, it is important in setting the context. Those states seeking sophisticated, compact weapons, or those seeking to construct them out of commercial (fuel-cycle derived) rather than specially produced military plutonium may decide it is necessary to test to verify yields. The credibility of a given state's program may therefore depend upon testing, and the international norm against such tests will remain very important.

What a state might do does not derive solely from its technical ability, but also from the will to act and the intended and perceived purpose of that act. Moreover, a state's actions will be colored not only by what other states perceive them to be capable of, but what they believe that state would actually do in certain circumstances. This leads to four general purposes for a public demonstration by a state of either the ability to construct an explosive or of an actual, usable weapon:

(1) to prove to others it is technically capable;

(2) to build internal confidence in the ability to develop a usable arsenal;

(3) to convince others it could acquire such an arsenal;

(4) to convince others it has an arsenal and would, under appropriate circum-

stances, consider its use—either in combat, for terror, for reprisal, or as a last resort. Technical and economic requirements for these several purposes differ markedly.

The audience for such a public demonstration is not so precisely definable for smaller powers as for the binary US-USSR or USSR-China systems, or for the derivative rationales of France and the UK.[7] Without state-specific analysis that includes perceptions of evolving military and security environments, actor preferences and purposes are not easily discerned. Moreover, the purposes listed above are not completely separable, nor may it be in the best interests of some states to remove or reduce ambiguities as to purpose or capability.

The classic arms control tactic of dichotomous bargaining is, as pointed out by Schelling, not applicable in such circumstances.[8] For the states being considered here, it is not clear which might be bargained with, over what, and whether there are any mutually commensurable goals about which negotiation can take place. Furthermore, there is no referent for deciding what actor capabilities are: what might be usable (or credible) against Zambia or Peru might not be credible (or usable) against Argentina or Iran.

Rather than attempting to delve into this menagerie, the rest of this essay defines some of the technical and economic capabilities and constraints that are likely to define the boundaries of achievable weapons and delivery systems for a variety of states. This heuristic exercise is aimed more toward divining what actors might become capable of than what they might, may, or will do. Some states will be little constrained by technical and economic factors. And even those that are so constrained are not bound to interpret the meaning of a weapon or a delivery system according to the rules of the more advanced industrial and military powers.

III. WEAPONS MATERIAL

Present nuclear weapons are constructed of either U-235 or Pu-239. Both of these are also fissionable by low-energy (thermal) neutrons, and so are also usable as fuel for present-design commercial nuclear power reactors. But this is not a necessary condition. Thermal neutrons propagate a chain reaction too slowly to provide the rapid energy release required for an explosion. Weapons reactions are propagated by high-energy (fast) neutrons, and many other isotopes, such as Pu-240, that are not thermally fissionable are also potentially usable for explosives. A notable exception is U-238, which tends to absorb neutrons and convert to Pu-239 rather than fission. Even for fast neutrons, U-238 will not sustain a chain reaction.[9]

U-235 is found in nature, at a concentration of 0.7 percent of the total uranium, the remainder being U-238. Plutonium does not exist in nature, but may be bred by

neutron absorbtion by U-238 and then chemically separated. Since the irradiated uranium is highly radioactive, "hot" chemical separation facilities are required. A third potentially usable isotope, U-233, is also not found in nature, but may be bred and chemically separated from naturally occurring Th-232. Although there are some doubts as to its utility for weapons in practice, U-233 is theoretically usable, and is included here for completeness.[10]

Nuclear explosives are simple in principle. For most fissionable isotopes, there is a certain mass of material (for a given density and geometrical configuration) for which the loss of neutrons through internal absorption or out through the surface just balances the generation through fission. If the mass or density is lower, or the geometrical configuration provides a greater surface area, neutron loss exceeds generation and the chain reaction dies out. If mass or density are increased, or surface area reduced, generation exceeds loss and the chain reaction propagates. If this is done rapidly enough to prevent melting or low-energy dispersion of the material, an explosion—the rapid release of energy—occurs: energy release is governed by the amount of material fissioned before the device disassembles.[11]

Two factors are of central importance to weapons design. The first is the amount of material needed, which is related to the geometry selected, and the second is the method of initiating the chain reaction at the proper instant. To prevent accidental initiation, the material must either be kept physically separated and assembled quickly, or arranged so that density or geometry prevent a self-sustaining reaction. In both cases, the material is either assembled or brought rapidly to a proper density or geometry by the application of explosive charges (in some cases, a combination is used). Since assembly is a dynamic and rapid-shock process, initiation of the reaction at the instant when the material is in the most favorable configuration is needed to maximize the amount of energy extracted (yield).

Weapons grade uranium (nearly pure U-235) obtained by isotopic separation has such a low rate of spontaneous neutron production that initiation is required. Although initiation is also required with plutonium weapons to maximize yield, it is not for lack of spontaneous neutrons. Pu-239 produced in reactors also absorbs neutrons, converting to Pu-240—a copious neutron emitter. To prevent possible pre-initiation with consequent reduction in yield, plutonium for military purposes is kept as low in Pu-240 as practicable, which implies rather short irradiation time of the uranium fuel in the reactor. Furthermore, more sophisticated designs (such as spherical implosion) providing more rapid assembly are required.[12]

The physics and technology of initiators has progressed very far since the 1940s, and a variety of more or less obvious techniques and devices is available to any state capable of designing a weapon.

Many technical and scientific skills are required for the design and construction of a nuclear explosive, but the level of sophistication and amount of material required depend upon the yield and reliability that is sought and the degree of miniaturization. A crude device might need several critical masses; sophisticated weapons with yields in the tens of kilotons can be made with somewhat less than a bare sphere critical mass (the critical mass in air in spherical solid configuration). Table 1 lists critical masses for uranium and plutonium; surrounding the material with a good neutron "reflector"

Table 1

Critical Mass Data for Several Nuclear Materials, Spheical Geometry [a] **(kg)**

Tamper	U-233	U-235	Pu-239 *	60% Pu-239/40% (Pu 240+Pu-242) *
Bare	16	56	11	15
Thick uranium metal tamper	(6-9) **	15	5	8

Notes:
[a] Sources: Theodore B. Taylor, "Nuclear Safeguards," *Annual Review of Nuclear Science*, 25 (1975), 407; Ernest J. Moniz and Thomas J. Neff, "Nuclear Power and Nuclear Weapons Proliferation," *Physics Today*, April 1978, 42-51; H.C. Paxton, "Los Alamos Critical Mass Data," Los Alamos Laboratory report LA-3067-MS (Revised)
* High-density phase. In lower density delta phase, critical masses are about 1½ times those shown.
** Estimated.

lowers the critical mass by reducing neutron loss through the surface. The reflector may also serve as a tamper, adding to the inertial forces holding the material together while the chain reaction starts. Yield data are classified, but the use of a good tamper-reflector and sophisticated design is known to reduce the material requirement by a factor of more than four.

A technique for boosting yield not much discussed in the public literature until the advent of the enhanced-radiation weapon is to enclose the device in a blanket of fusion material such as LiD. The triggered multiplication of neutrons vastly increases yield, allowing for much smaller devices or much higher yields from conventional ones.[13] Boosted weapons might be too sophisticated for some of the states on our list, but certainly not for all. Thus, weapons ranging into the hundreds of kilotons cannot be ruled out.

For most of the states on our list, the material used will be plutonium. U-235 is difficult to obtain from present suppliers, and the isotopic separation technology required to extract it from natural or low-enriched material is still very expensive and difficult to construct. However, the advent of lower cost and less difficult separation technologies (such as laser enrichment) could change this situation by the end of the 1990s. U-235 would be preferable from many viewpoints, particularly for relatively crude designs, but larger devices are required owing to the greater critical mass.

U-233 has a relatively small critical mass and a low spontaneous neutron rate, and is easily bred from Th-232. However, the technology for its chemical separation is not as well advanced as for the separation of plutonium from uranium.[14] There may be additional difficulties owing to the growth of gamma radiating daughters of U-232 with time, making the material progressively harder to handle.[15] It is unlikely to be preferred if other material is available.

The cost of a committed plutonium production program would not be great. A small production reactor designed to produce relatively pure Pu-239 can be built in a few years for a few tens of millions of dollars.[16] The required hot chemical separation facility could also be built in a few years for some tens of millions of dollars.[17] Such a combination could produce enough material for a few nuclear explosives a year, or more, if design is sophisticated. There is no reason to believe that a state embarked on a dedicated weapons program would settle for less. If the program were totally open, it would be cost-effective to design and construct for some tens of weapons per year. The capital cost of a plutonium production complex of this larger scale is unlikely to exceed one billion (1976) dollars, including all radiological protection features.

The size of the deliverable weapon itself would depend more upon such other design considerations as the amount of high explosive needed than the mass of fissionable material required. It is more convenient for our purposes to combine the weight of all functional and structural components into a single index—overall size and weight—that governs the type of delivery system needed. Three categories seem useful:

- crude: total mass over 500 kg, diameter over one meter;
- median:total mass between 100 and 500 kg;
- sophisticated: total mass less than 100 kg, diameter less than 15-20 cm.

Plutonium devices would be roughly spherical. A median device of good design would be roughly 200 kg and 40-50 cm in diameter. A crude device can be the size of a small truck.

For most of the states on our list, yield will probably be in the range of a few kilotons to a few tens of kilotons, whatever the size. For some, controllable and/or boosted yields, covering the range from less than one kiloton to many hundreds of kilotons, will be available.

IV. THE COMMERCIAL FUEL CYCLE AS A SOURCE OF MATERIAL

Construction of a dedicated weapons program will take considerable time and money, although it is assumed throughout the preceding discussion that certain specific technical skills and types of supporting equipment will be available as a consequence of the use of commercial nuclear technology (otherwise time and cost would be far higher). States not having a reasonable peaceful nuclear program are therefore unlikely to develop a military one. Commercial technology may also contribute directly. If a state feels it cannot afford separate military and commercial facilities or, in times of crisis or revolution where rapid production of large quantities of weapons material is sought, the commercial fuel cycle can also be put to use—even at the cost of breaking safeguards arrangements or treaties and agreements.

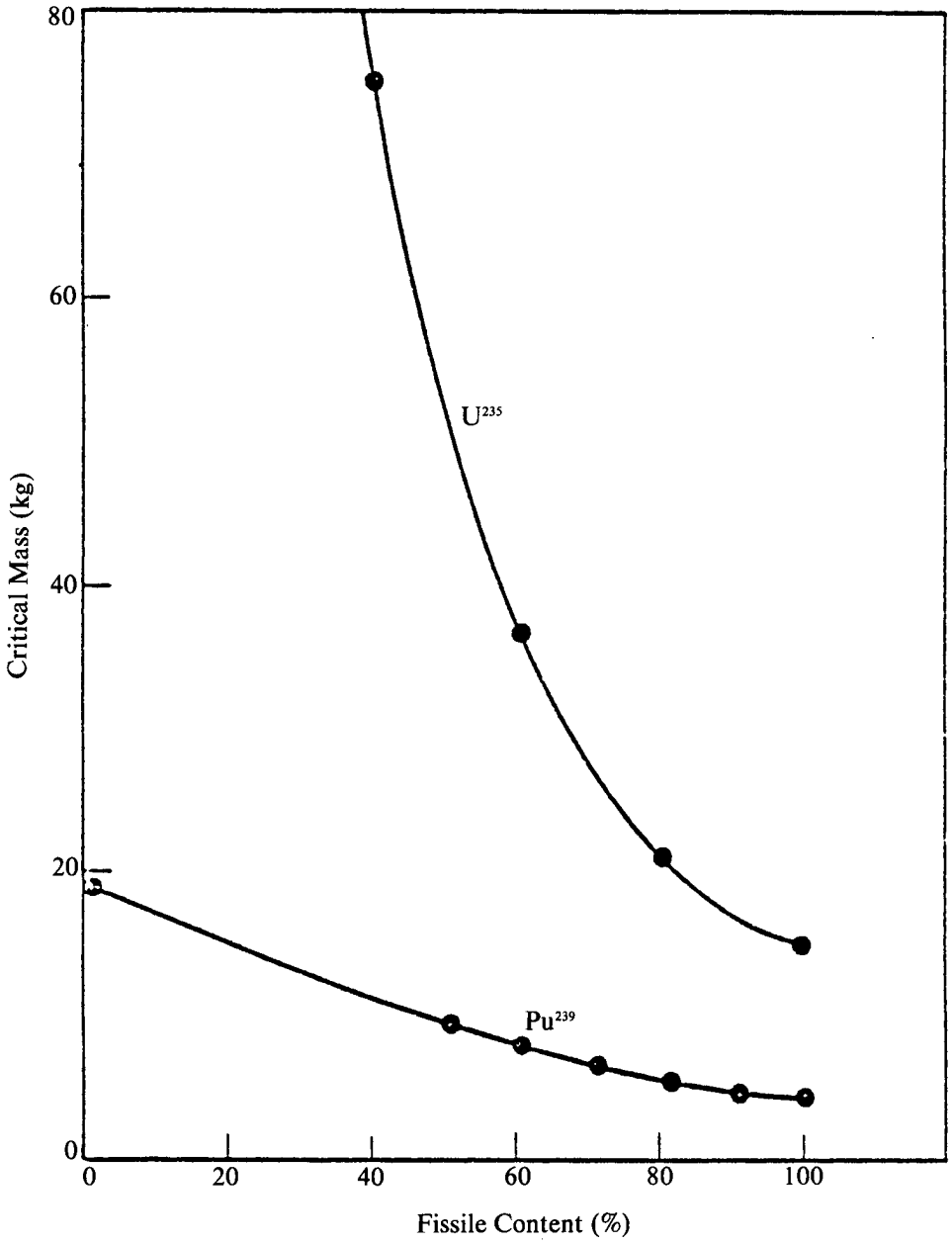
As is shown by Figure 1, low-enriched uranium (e.g. for reactor fuel) cannot be used directly. Material enriched to 15-20 percent U-235 concentration is also difficult to use for weapons. Crude isotopic separation procedures could, however, be used to produce weapon-usable material. If only a crude device is wanted, great purity is not required.[18] Highly-enriched U-235 is available for research, and sometimes for fueling of high-temperature gas-cooled reactors (HTGR). Separation from the graphite moderator is not technically difficult. Nevertheless, large quantities are not currently available, and modifications to the HTGR can remove the necessity for high-enrichment fueling.

Plutonium is produced in all but highly enriched uranium fuels. A shift from the present dependence upon uranium to plutonium fueling would make plutonium accessible in unirradiated fresh fuel, from which it could be separated fairly easily without the necessity for extensive radiation shielding. As shown by Figure 1, no isotopic mixture of plutonium available in the commercial fuel cycle is unusable for weapons. In fact, the critical mass for Pu-240 is only about four times that for Pu-239 (and less than that of pure U-235).

At one time it was believed that the presence of a large fraction of Pu-240 in commercial plutonium afforded a measure of protection, since the large neutron background greatly increased the probability of pre-initiation and very low resulting yields. The Pu-240 cannot be removed by any known isotopic separation process with any degree of efficiency, but it is now recognized that careful attention to design can greatly reduce or control the unpredictability of yield. Militarily useful devices with yields reliably above the range of a few kilotons can be constructed from fuel-cycle plutonium even with relatively unsophisticated technology.[19] Although less efficient and predictable, it will suffice for a state having no access to better material. Moreover, states possessing more sophisticated design teams can obtain reliable and higher yields.

Figure 1

The Critical Masses of Uranium and Plutonium



Notes: a. Source: Moniz and Neff, *op cit*. Both materials are assumed to be in the form of high density metal spheres in a thick uranium reflecting shell. Fissile content refers to Pu-239/total plutonium or U-235/(U-23 + U-238)

The three categories used before (crude, median, sophisticated) remain the same if fuel-cycle plutonium is used, although yields are likely to be smaller, particularly for crude devices. However, access to booster technology could still allow very large yields to be obtained.

V. IMPLICATIONS FOR DEVICE INVENTORIES

How many nuclear explosives a state would have, and of what kinds, is a matter of policy choice; the question to be addressed here is what constraints are imposed on the range of choices. Almost any state with a commercial nuclear technology program can construct a small reprocessing plant and associated production reactor for a few critical masses of plutonium per year. The facility would hardly qualify as a "plant"—it would more resemble a large experiment.

A plant capable of reprocessing 50 Mg/yr—the size of WAK at Karlsruhe and half the size of Trombay—could produce enough material for one median explosive (or two sophisticated ones) per month. The reactor to feed it would be perhaps 600 Megawatts (thermal), about one-fifth the size of commercial plants. This is the model one billion (1976) dollar program mentioned above. Diversion of commercial spent CANDU or LWR fuel in an emergency or crisis would more than double the plutonium production rate, but the plant would have to be designed for such an adaption from the outset.

Only if a state were conducting a quite small, clandestine program would rates be expected to be as low as a few weapons per year. Since this is not the assumption for this colloquium, the baseline should be taken as ten to twenty per year for a small program, with the capacity to more than double this rate in a crisis by diverting fuel cycle materials.

States having commercial-sized reprocessing plants, whose throughput is typically ten to thirty times as large, could produce dozens of weapons per month in a crisis, provided source material and other components were prepared. States using plutonium fresh fuel would also have material for many dozens of weapons, more or less at hand, that could be easily separated by more conventional, and less detectable, chemical facilities. Or, given a change in present non-proliferation norms, a state could run a joint military-commercial facility and produce many tens of weapons per year without seriously interfering with commercial reprocessing.

VI. INDIVIDUAL CAPABILITIES

Our hypothetical list of states that might have, or be considering, a capacity to build nuclear weapons includes Argentina, Brazil, Egypt, the FRG, India, Iran, Israel,

Iraq, Japan, Libya, Pakistan, South Africa, South Korea, Spain, Sweden, Taiwan, and Yugoslavia. Their potentials are quite different.

The FRG, Japan, and Sweden could rapidly acquire extensive and sophisticated arsenals, boost for high yield, and perhaps pursue true thermonuclear weapons. Most other states in this position are European.

In the next rank, Israel is limited by the availability of source material. South Korea and Taiwan also have the technical capability, but at present are under strong external political restriction against reprocessing. Somewhat behind these are India, which has some experience, and South Africa, which is rumored to be developing some. Both have indigenous uranium supplies. All of these states have an ample technical and technological base, and could be moving toward sophistication in weapons design rapidly in the 1990s.

Argentina, Brazil, Egypt, Iran, and Pakistan are further behind in the number and quality of needed technical personnel, but are already moving to improve this as part of their commercial programs. By the 1990s, all should be capable of designing and constructing median devices. Libya and Iraq are far more limited in experience and personnel, and would be restricted to crude devices in the 1990s unless a major push for training occurs. Of course, most OAPEC states are not poor; they have ample funds to hire needed expertise if they so desire. Industrial infrastructure limitations are likely to be the major constraint.

More than half the states on our list could have some hundreds of fairly sophisticated nuclear devices available by the mid-1990s, allowing for possible battlefield use even where losses are high. The rest are likely to be limited at first to smaller numbers of median devices, but could be moving rapidly toward larger numbers and more sophistication by the end of the 1990 decade.

Both technically and economically, restrictions on the availability of delivery systems would then be the more important consideration. But these are also likely to become more widely available, and less expensive.

VII. DELIVERY SYSTEMS

Technical barriers against development of nuclear explosives are becoming lower, even as states strive to keep political barriers and norms against their development and use high. For delivery systems, on the other hand, technical and economic barriers have been growing in a near absence of political barriers or norms against their export.

A usable delivery system entails, to some extent, the penetration of enemy territory against detection and defense that is becoming increasingly sophisticated. This is why the technical-economic barriers have been growing. The great powers have been exporting all but their most advanced electronic technologies (and sometimes even those) along with their latest aircraft, missile, and other systems, with general restrictions applied only to unambiguously nuclear delivery systems such as the Pershing missile. Therefore, a state considering conflict with a similarly armed neighbor must worry about the credibilty and reliability of its force. However, it is now feared that new weapons developments will lower technical barriers and, by blurring the line between offensive and defensive, conventional systems and nuclear ones, make the imposition of controls more difficult.

ICBMs and Polaris submarines are not needed; the range of military possibilities is much broader for the states on our list than for superpowers contemplating fighting a full-scale war across many thousands of km. A delivery system is no more than a means for reliably placing a weapon before detonation where it is wanted. It is necessary, therefore, to run through a gamut of possibilities.

A. Ballistic Missiles, Submarines, and Long-Range Strategic Bombers

None of these delivery systems—which are the backbone of the US strategic forces—is likely to be acquired by even the most advanced of the states on our list by the 1990s.[20] However, intermediate-range ballistic missiles, and the retrofitting of existing submarines or surface ships to carry them are possible. The advent of the cruise missile (discussed below) would allow a variety of aircraft to be used as the equivalent of long-range bombers. Guidance systems are a major stumbling block in missile development, but the prospect of improved commercial guidance systems or precision navigational aids (e.g., by satellite relay) could seriously lower—or remove—this technical barrier.[21]

B. Shorter Range Missiles

A variety of short-range ballistic missiles are now on the international arms market, and many more are likely to appear in the next decade or two. The US is reluctant to market the 600-km range Pershing for now, but as shown by Israeli development of the comparable Jericho and the recent Taiwanese unveiling of their new missile, indigenous capabilities are increasing to the point where that soon may not matter. Shorter range battlefield missiles such as Lance, Frog, and Scud are already widely exported; in geographically compact arenas they are semi-strategic as well. Ship-launched missiles such as Harpoon, Exocet, Otomat, and Gabriel can be

adapted for shore targets or land use. They are a bit small except for very sophisticated nuclear weapons, but larger versions could easily be developed.[22]

Tactical missile development is being avidly pursued by many states, and the line between those that are nuclear-capable and those that are not blurs as size and weight of the missiles increase. With the addition of laser-designated, inertial, or data-link guidance, these missiles could become formidable in arenas where distance is measured in hundreds rather than thousands of km. In the Middle East or Southeast Asia, the high-speed, missile-armed patrol boat could be used as an effective threat or deterrent, as a first-strike, or as a quick-response weapon.

C. Fighter-Bomber Aircraft

Paradigmatic of delivery system ambiguity is the F-15; now being exported only to a few states, exports of the F-15, its successors, or European or Soviet equivalents, may increase and spread. Sold as an interceptor, the F-15 (capable of carrying many thousands of kg) is a formidable delivery vehicle, and may be considered not only a tactical, but a strategic nuclear delivery vehicle in many parts of the world. Other nuclear-capable high-performance aircraft that are widely exported include the ubiquitous F-104, F-4, and F-5, and the new F-16 from the US, the French Mirage III, V, and F-1, the multinational Specat *Jaguar* and Panavia *Tornado*, and the Soviet MiG-21, MiG-23/27, and the Su-20/22 export versions of the Su-17. France has a new Mirage 2000, Israel the new *Kfir* C2, and Sweden is seeking customers for its Saab 37 *Viggen*. All can carry nuclear weapons, although capabilities vary. The Mirage F-1, for instance, although sold as a lightweight high-performance fighter, has four hard points for mounting 450 kg external ordnance.

Among slower aircraft of higher payload, the US A-4 is widely exported and the A-7 could be. There have also been sales of medium bombers, notably the Hawker-Sidley *Buccaneer* and the widely-produced *Canberra*, and some export of the Soviet Tu-16 (a cruise missile carrier). All are low and slow by modern standards, and are likely to remain survivable in the 1990s only in areas (such as South America) where export restrictions by the great powers continue to be enforced.

New vehicles are likely to become available. For instance, the new F/A-18 is rated for over 10,000 kg of external ordnance, and technical data for export licensing have already been applied for by at least nine states.[23]

D. Other Aircraft

Depending upon the mission chosen, the expected level of air defense along the mission track, and the risk of loss that can be accepted, nuclear explosives can be

carried by a variety of aircraft ranging from giant 747s to *Alphajets* and T-28s. Although not suited for land war in Europe, these aircraft may be adequate for smaller states under appropriate circumstances, and may provide conveniently confusing delivery for surprise. If cruise missiles are developed, large commercial aircraft become effective long-range stand-off bombers, operating almost totally within territorial or other heavily-defended airspace.

E. Penetration

F-15 and similar aircraft can be used for high-speed, high-altitude penetration, particularly if accompanied by air-defense suppressor aircraft. Low altitude roles are becoming more possible with the export of better avionics. The Mirage 2000, for instance, is proudly advertised as possessing automatic terrain-avoidance radar navigation. Some states, such as Israel and Taiwan, may also find a lucrative market in exporting such advanced guidance to retrofit aircraft exported without it.

F. Ordnance

With respect to size, the AIR-2A nuclear air-to-air missile, designed in the 1950s for air defense, weighs less than 400 kg, including rocket motor, whereas the standard aircraft ordnance fitting is 450 kg for "light" pylons. Many of the states on our list could easily match this technology now, and many more will be able to by the 1990s. Air-to-surface guided missiles with ranges upwards of 100 km (resembling the current Anglo-French Martel or German Kormoran, or the larger German Jumbo or Swedish RB-04) should become widely available.[24]

Guidance technology should diffuse rapidly. "Smart" bombs such as Walleye (already available in a nuclear-capable model) and Maverick, both used in Vietnam, are only the beginning. Guidance systems can even be removed from smaller systems, such as Maverick, and refitted to nuclear-capable ones, or replicated. There is no reason to doubt that there will be a variety of potential suppliers by the 1990s, even for states not capable of indigenous development.[25] As an intermediate step between free-drop bombs and internally-guided cruise missiles, these smart systems will be the most effective from both cost and military viewpoints. Their frequent neglect in analysis is a serious oversight.

G. Cruise Missiles

Externally guided vehicles, whether winged or true ballistic, are becoming obsolete. Cruise missiles are internally guided, using stellar or automatic data-link guidance, or terrestrial mapping systems such as the newly-developed TERCOM fourier-transform radar navigation. They may also be winged or wingless—low-speed

ground-hugging miniature aircraft, high-speed sprint missiles, or any combination in between.[26]

Cruise missile technology is within the reach of many small states. Neither airframe nor engine technology should be much of a problem. The US is developing its advanced ALCM and SLCM to be high-performance, low cost, and fittable to existing bomber and submarine fittings. Smaller states do not operate under such restrictions. Since they will seek at most hundreds, rather than thousands, and may be content with ground launch, larger and far more expensive cruise missiles can be afforded. Only the poorer and less technically advanced states on our list do not have an aircraft industry of some type. Engines such as the 1350 kg thrust GE CJ610-6 used for business aircraft are widely available without restriction. Several engines in the 500 kg thrust class, the size intended for ALCM and Otomat, are becoming available, and may become more openly purchasable by the 1990s.[27]

Self-guidance technology for countervalue targeting will increasingly fall within the capabilities of smaller states within the next two decades. Inertial guidance systems unsuited for the high g-loads of ballistic missiles are more adaptable to cruise missiles, and high accuracy is not always required. Advanced TERCOM, desired by the United States to allow for flexible programming against many types of targets, may not be needed. If targets are pre-designated, launch point adaptability is all that is required. Some targets, such as cities on bays, are so clearly identifiable as to present little difficulty. Furthermore, the principle behind TERCOM is not at all mysterious. It is primarily an advanced electronic engineering problem, and many states are progressing very rapidly in electronics. Miniaturized components are becoming cheaper, more efficient, and more widely available almost daily. By the 1990s, even complete TERCOM systems could be available on the international arms market.

The prospective spread of cruise missiles for what are ostensibly conventionally-armed missions presents difficult verification problems. A missile with a 500-kg high explosive warhead and a range of 600 km, for instance, could be configured to 1500-km range with a 200-kg nuclear warhead and 300 kg of extra fuel. It would be externally indistinguishable. France and the UK, among others, are now considering adopting cruise missiles for nuclear delivery, and there will be a temptation to recover some costs by marketing conventionalized versions abroad. Moreover, development times for cruise missile technology are likely to be far shorter than for piloted aircraft, and several new missiles could appear by the 1990s that are not now under design.[28]

H. More Exotic Delivery Systems

Many of the states on our list do not have potential opponents so far removed or tightly controlled as does the US. Many of these depend upon imports for basic goods

even during wars. Nuclear explosives could be smuggled in as surface or air freight, perhaps via a third (neutral) party, and detonated remotely or upon customs inspection or simply upon arrival at dock or airport. If shipped as containerized cargo there would be ample room and weight for thorough shielding against casual inspection. Such delivery is, of course, always available as a first or pre-emptive strike option against almost any unwary target, not excluding the US. Thus, the spread of nuclear weapons can pose a serious, if limited, threat even to the superpowers.

VIII. COMMAND AND CONTROL

Perhaps of even greater concern to the US and other world powers, as well as to states such as Israel and South Africa whose legitimacy itself is challenged by others, is assurance that deployed nuclear weapons remain under the command of central governments and under secure control. A variety of command and control procedures is needed to ensure that weapons are not usable by local or field commanders without consent of political authorities, or do not become usable at home or abroad during times of revolution or civil disorder when authority itself is not clearly defined. There is also need for security against theft by terrorist, insurrectionary, or criminal groups, since these weapons could be sold abroad as well as used for domestic threat. This range of problems has been a concern even for US and Soviet forces in Europe.[29]

It would clearly be in the interests of the great powers to aid and assist with the development and use of adequate physical security measures. It is possible that this would extend to assistance in devising central control procedures and technologies, such as the permissive action link (PAL) used to ensure that US weapons cannot be detonated without authorization. However, the US would probably be reluctant tc divulge too much detail of PAL to states whose secrecy and security for such information is sometimes questionable. This will present a considerable dilemma.

Yet another dilemma is likely to be posed if military, security, or political concerns are so great that larger powers insist upon the adoption of command and control measures or the fitting of PAL. If the transfer of this technology is insisted upon, smaller states could extract a considerable price—ranging from assistance with weapons or delivery system-design to alliance and security agreements—for their adoption.

IX. WHAT FORCE STRUCTURE MIGHT STATES CONSIDER?

With the exception of the FRG and Japan, the states being considered here are unlikely to commit the technical and economic resources needed to develop multi-mission, multi-role mixed strategic and tactical forces even at the scale of the UK or France. Some simply will not be able to afford it even if they so desired. In a rational

world, these states would select forces appropriate to specific missions against a range of anticipated opponents.

The first matter to be settled is that of basic posture. Nuclear explosives can be used strictly as a deterrent, to demonstrate early commitment, to improve bargaining position, for political dominance, hegemony, or equivalence, either regionally or locally, to improve combat ability, or strictly for defense. Depending upon whether the weapons are seen as instruments of combat, of terror, or simply as defensive supermines to secure borders, different structures must be considered.

This does make a technical difference. If deterrence is sought, forces must be capable of riding out a pre-emptive strike and providing a credible response. If primarily used for "coercive diplomacy," less survivable forces may still be acceptable.[30] Forces intended for battlefield, interdiction, or purely defensive roles can be less sophisticated, since they can be hidden and brought out on short notice without the need to be constantly up and ready for use. Moreover, and unlike the traditional European situation, these states are likely to have a range of potential adversaries in mind, some neighboring and some more distant, and a correspondingly diversified set of forces. Finally, there is no assurance that all the states on our list will behave rationally and select forces appropriate to the roles perceived by others. For such nonrational (but not irrational) motives as the desire to emulate superpowers, they may opt for seemingly global delivery systems.

This apparent confusion will not be perceived by the states themselves, since each will have specific missions in mind, but it does introduce a great deal of complexity into global analysis. Even though the US has twice considered the use of nuclear weapons in Asia, the present range of possible nuclear warfare scenarios is comparatively simple. With the extension of nuclear weapons to large numbers of other states, there would be the need to analyze a host of potential smaller and more diverse conflicts to try and determine whether and where nuclear-capable states involved might decide to use their weapons, what might be done to intercede, and what the implications are of either the use or the intercession.

X. VULNERABILITY

An important consideration will be the relative vulnerability of different forces and force mixes in combat or to pre-emptive strikes. Hardening against full-scale nuclear attack is an option available to states with offensive missile forces, since the technology to defend against the limited attacks of similar opponents should not be too difficult. Resistance to superpower attack is probably out of the question technically. However, the forces being considered for most of our list in the 1990s will be relatively

vulnerable aircraft or similar systems, and secrecy and concealment in deep mines or caves are likely to be the dominant protective mode. This does slow response, however, and may make a pre-emptive strike more attractive to opponents.

Another contributing factor to the risk of pre-emptive strikes is the greater vulnerability of embryonic forces seeking parity with an opponent. Clearly, there will be periods of great risk during the development and deployment phases as these countries arm—perhaps much greater than the risk once all are actually armed. When large numbers of weapons are produced, it is difficult to be sure that there are not many concealed for future retaliatory use via infiltration or other clandestine delivery. Unlike the technical race for invulnerability among the superpowers, among the smaller powers invulnerability is likely to depend more upon intelligence and espionage and, consequently, be less stable.

XI. TECHNICAL LIMITATIONS

With regard to weapons, none of these states is likely to have megaton-yield devices in the 1990s, although the more advanced, through boosting, could have weapons in the hundreds of kilotons. Leaving aside ICBM or missile-submarine forces as unachievable in our assumed time frame, the more advanced states such as Japan and Sweden could probably develop almost everything they might want. Israel and Taiwan, and other similar states might be restricted to shorter range systems but, aside from this, should be able to build or purchase much of what they need with minimal outside assistance. Libya and Iraq, at the bottom of our list technically, would have more difficulty owing largely to restrictions on indigenous technical and industrial skills. However, it is possible that they too could purchase almost everything they need — including personnel. Much depends upon the future development of arms sales markets, both open and "gray."

This is an area where more detailed state-specific analysis is required. For those states not now capable of designing and constructing their own components and delivery systems, how much improvement is anticipated in the next decade, and at what level? To what extent can some lines of development or acquisition be blocked by weapons-exporting states if identified? Where might political agreements slow or prevent the diffusion of specific, needed technologies? Research in these areas is pressing and important.

Nevertheless, it should be realized that many of the states on our list are already capable of complete, or near-complete, indigenous development and construction of complete weapons and delivery systems suitable for at least local and regional conflict.

XII. ECONOMIC LIMITATIONS

For many of these states, the question is not what they would like to have or are capable of developing or purchasing but how much they can afford. The US can afford to spend several billions of dollars a year on nuclear weapons. (Perhaps in the larger sense it cannot but, in budgetary terms, it not only can but does.) Smaller states are more restricted. The question is: What are their limits?

Table 2 lists some recent military budgets for some of the states on our list, both absolutely and as a share of national budgets. For comparison, our reference ten-to-

Table 2

Military Expenditures [a]

State	1974 National Budget, US $ * (billions)	1974 Military Expenditure, US $ (billions)	Percentage of Budget for Military, 1974	1976 Military Expenditure 1978 US $ ** (billions)
Argentina (1972)	4.7	0.70	15	1.21
Brazil	7.9	1.20	15	1.52
Egypt	2.35	3.14	***	4.0
FR Germany ††	—	12.0	—	15.5
Iran	10.8	4.73	44	9.4
Israel	6.2	4.62	75	4.06
Japan ††	—	3.40	—	5.0
Pakistan	1.71	0.57	33	0.78
Sweden ††	—	1.81	—	2.43
Taiwan	2.27	0.86	38	1.14

Notes:
[a] Source: 1978 SIPRI Yearbook.
* 1974 data presented at 1974 exchange rates, except as otherwise noted.
** 1976 data converted to 1978 prices and 1978 exchange rates.
*** U.S. ACDA data show 1.5 billion, and 70%. SIPRI data show more than 100% of budget for arms, an obvious discrepancy.
†† Data given are for 1973, expressed in 1973 exchange rates.

twenty weapon per year program is assumed to cost about one billion (1976) dollars, and take five years to construct.[31] Including operating costs, each weapon would cost about $20 million (1976) dollars.[32]

Delivery systems and associated defense do add considerably to the expense. Let us assume the following moderately diversified force structure:

—20 F-15 type aircraft at $25 million (1976) dollars each:	$500 million
—40 F/A-18 or equivalent at 10 million dollars each:	400 million
—200 "Walleye"-type guided bombs at 0.5 million dollars each:	100 million
—200 cruise missiles at 1 million dollars each:	200 million
—4 Lance-type missile brigades at 100 million dollars each:	400 million
Total direct acquisition cost	**$ 1.6 billion**

Adding another 800 million (1976) dollars for support and infrastructure, radar, training, and so on, the total cost would be on the order of 2.4 billion dollars, spread over five years.

Allowing about 25 percent for cost escalation (not inflation), the total force cost would be about 4.25 billion (1976) dollar, or about 850 million dollars per year over a five-year deployment period—somewhat less if amortized over seven years or a decade. There are no states on our list that could not afford this, albeit in some cases with some strain. Other states could easily afford it.

XIII. TECHNICAL AND INDUSTRIAL INFRASTRUCTURE

Two other limitations may be more serious. A state not having adequate technically trained personnel or industrial infrastructure would have to expend far greater sums than the direct costs mentioned above. However, even states toward the economic bottom of our list, such as India, Pakistan, and Korea, have long traditions of education and training, and weapons and delivery systems require only modest numbers of highly trained personnel, not enormous quantities of moderately trained ones.[33] Those states with commercial nuclear industries underway or under development are already developing most of the needed technical and industrial base. Others, such as Israel, Brazil, and India, have aircraft industries of their own, capable of producing cruise missiles and other types of systems. Sweden, Israel, Japan, and the FRG, have high-technology industries capable of very advanced ones. Except for these four, the ability of states to pursue indigenous weapon system development may be restricted by the need to import foreign personnel and acquire related necessary industrial skills.

Military infrastructure is also in need of detailed analyis. It has been widely noted that some states (Saudi Arabia for example) cannot make effective use even of the conventional weapons they have purchased. To effectively integrate nuclear weapons into existing forces, some states will have to upgrade their overall military capabilities considerably in the next decade, and that could require large investments of time,

personnel, and money. If delivery systems are purchased abroad, however, and are not clearly identified as nuclear, weapons suppliers may provide assistance in training and upgrading indigenous personnel, as they now do for advanced fighter aircraft they export. Moreover, the perceived need to assist with PAL or other command and control systems, even for an openly nuclear force, may lead the US and others to upgrade local forces for the sake of their own overall security or military position.

XIV. CONCLUSIONS

Purely technical and economic constraints do not limit any of the states on our list from acquiring nuclear weapons and delivery systems capable of, at the minimum, providing a credible threat to neighbors. For many, this would be adequate. Others may seek more, and many are capable of acquiring far more. Nevertheless, only the FRG and Japan, the most capable on our list, could seek as much as parity with France as nuclear powers by the end of the 1990s.

Development and exports of more sophisticated defense systems over the next decade could, however, severely limit the ability of many of these states to provide a credible threat of military use against an alert opponent. Whether this is stabilizing or destabilizing will depend upon the local context. Little can be done to prevent pre-emptive, clandestine, or sneak attacks on many of these states, since they present only a few targets worthy of nuclear attack, and only small numbers need be delivered. On the other hand, this does allow for more effective territorial defense, once alerted.

Whether any of these states would consider nuclear devices as battlefield weapons, either in combat or for interdiction, is more doubtful. There are still norms against such use. Moreover, nuclear weapons will be expensive and not very numerous in the 1990s, even assuming full-scale programs are started in the 1980s. By the end of the century, however, rapid production and the development of less extensive delivery systems such as cruise missiles could remove both economic and scarcity barriers to battlefield use.

What could be done to delay or halt such developments through controls on weapon and technology exports and transfers is in need of further study. High-performance aircraft, short-range missiles, and guided bombs are all marked for present or future export as conventional weapons. Inertial guidance and TERCOM are at present more restricted, but indigenous capabilities could greatly increase over the next decade. Although superpower technology will also advance, the states on our list are generally more likely to engage in conflict with one another, and the latest technology may not be deemed necessary.

What could be done to slow the spread of nuclear explosives themselves has been the subject of much recent discussion and study. It is more a political than a technical problem. I have assumed, in line with the predicate of our colloquium, that states will proceed openly with committed programs rather than adapt or divert commercial materials or facilities. In any case, the existence of commercial nuclear technology supplies much of the needed training and infrastructure. However, the marginal cost of developing an effective nuclear force can be much smaller than that cited here if diversion, theft, or open co-use of commercial materials, technologies, and facilities is chosen. Moreover, the marginal costs of delivery systems can also be much reduced if adapted from conventional use (for example, the F-15) rather than specially designed.

The ability to acquire systems on the economic and technical margin raises the possibility of instability in time of crisis, for states could seize and adapt existing nuclear and military instruments very quickly and (by comparison) if the incentive to do so overcomes treaties, agreements, and norms prohibiting such action. Over the next decade or two, the states on our list and others will progressively edge closer to becoming nuclear-capable, even if they have no intention of doing so. By the 1990s the marginal costs of acquiring usable nuclear weapons may become so low that states may find the decision far easier than it is now. If such diffusion is to be prevented, political barriers against taking the nuclear weapon decision will have to be made higher and stronger. Technical and economic barriers are becoming increasingly unreliable as technical and industrial skills and military capabilities increase.

The proliferated world of the 1990s contemplated here will have to be policed by political, military, security, and export assistance and control measures in great variety and complexity if some local conflict or event is not to trigger the first use of nuclear weapons since the largely unexamined decisions of 1945. And it is the political and normative effect of their use rather than the direct impact that is likely to have the most wide-ranging implications for future conflicts. Perhaps it would be best to end this essay where it began, with the last scene of *Hamlet*:

> Horatio: And let me speak to the yet unknowing world
> How these things came about. So shall you hear
> Of carnal, bloody, and unnatural acts,
> Of accidental judgments, casual slaughters,
> Of deaths put on by cunning and forced cause,
> And, in this upshot, purposes mistook
> Fall'n on the inventors heads. All this can I
> Truly deliver.
> *Hamlet*; Act V. scene ii.

FOOTNOTES

[1] M. Leitenberg, "Background Information on Tactical Nuclear Weapons," in *Tactical Nuclear Weapons: European Perspectives*, ed. Frank Barnaby for SIPRI, London, Taylor and Francis, 1978, pp. 3-136, points out that this was largely true of the development of tactical nuclear warfare doctrine in NATO. This is borne out by other articles in the collection.

[2] Martin J. Sherwin, *A World Destroyed: The Atomic Bomb and the Grand Alliance*, New York, Knopf, 1975.

[3] *Tactical Nuclear Weapons, op. cit.* Each of the ten authors in this volume discusses this to some extent.

[4] This idea was first advanced by Harold Feiveson. For an excellent discussion and analysis, see Ted Greenwood, Harold A. Feiveson, and Theodore B. Taylor, *Nuclear Proliferation: Motivations, Capabilities, and Strategies for Control*, New York, McGraw-Hill for the Council on Foreign Relations, 1977.

[5] Thomas C. Schelling, "Who Will Have the Bomb?", *International Security*, Vol. 1, No.1, Summer 1976, pp. 77-91.

[6] Albert Wohlstetter et, al., *Moving Toward Life In a Nuclear Armed Crowd*, Los Angeles, Pan Heuristics, 1976, provide a useful categorized list.

[7] See, for example, Geoffrey Kemp, "Nuclear Forces for Medium Powers," *Adelphi Papers* No. 106, 1974, for Part I; and 107, 1974, for Parts II and III, (London: International Institute for Strategic Studies, 1974) for the rationale for medium powers. Similar issues for smaller powers are discussed by Richard K. Betts, "Paranoids, Pygmies, Pariahs, and Nonproliferation," *Foreign Policy*, Vol. 25, 1977, pp. 157-183.

[8] Thomas C. Schelling, "A Framework for the Evaluation of Arms Control Proposals," *Daedalus*, Vol 104, No. 3, Summer 1975, pp. 187-200.

[9] In technical terms, the cross-section for neutron absorption is so large compared to the fission cross-section over the whole energy spectrum that the fission of one atom has less than unit probability of triggering fission in another. It is not just that the critical mass is "infinite." There is no critical mass for U-238.

[10] Cf. "Report to the American Physical Society by the Study Group on Nuclear Fuel Cycle and Waste Management," *Reviews of Modern Physics*, Vol. 50, no. 1, Part II, January 1978, p. S 102.

[11] The complete fissioning of 570 grams of material provides the energy equivalent of 10 kilotons of TNT, by convention. Early weapons had very low efficiencies, and large quantities of material were required to get appreciable yields.

[12] These are also useful for uranium weapons, but are not required. Simpler, gun-type assemblies can be used.

[13] Only recently, and especially since the advent of the enhanced-radiation weapon ("neutron bomb"), has boosting become much discussed in the open literature. For example, see the discussion in Fred M. Kaplan, "Enhanced Radiation Weapons," *Scientific American*, Vol. 238, No. 5, May 1978, pp. 44-51.

[14] "Report to the American Physical Society," pp. S40, S169-S170.

[15] "Report to the American Physical Society," p. S154.

[16] John R. Lamarsh, "On Construction of Plutonium Producing Reactors By Small and/or Developing Nations," *Nuclear Proliferation Factbook*, Washington, D. C., GPO, 1977, pp. 533-562.

[17] John R. Lamarsh, "On the Extraction of Plutonium From Reactor Fuel by Small and/or Developing Nations," *Nuclear Proliferation Factbook*, pp. 563-585.

[18] See Figure 1. Critical mass data are not a good guide to yield, which will decrease somewhat more sharply than indicated by this data.

[19] Office of Technology Assessment, U.S. Congress, *Nuclear Proliferation and Safeguards*, New York, Praeger, 1977, Chapter VI.

[20] Wohlstetter et al., op., cit., Chapter V, thoroughly analyzes this for Japan, one of the most advanced states on our list.

[21] For example, see Deborah Shapley, "Technology Creep and the Arms Race: Two Future Arms Control Problems," *Science*, October 20, 1978 pp. 289-292.

[22] *Aviation Week and Space Technology*, 1978 Aerospace Forecast and Inventory, March 13, 1978, provides a useful list.

[23] Much of this data came from *Aviation Week*, March 13, 1978. Another useful source is John W. Taylor, ed., *Jane's All the World's Aircraft*, published annually by Jane's Yearbooks, London.

[24] *Jane's All the World's Aircraft*, 1977-78, London: Jane's 1978; also see *Jane's Pocket Book of Missiles*, ed., Ronald Pretty, New York, Collier, 1976.

[25] "Smart" bombs are extensively discussed in Tom Gervasi, *Arsenal of Democracy: American Weapons Available for Export*, New York, Grove Press, 1977.

[26] Kosta Tsipis, "Cruise Missiles," *Scientific American*, 236, no. 2, February 1977, pp. 20-29 provides a brief, non-technical, and clear description of TERCOM and cruise missile technology for the lay person.

[27] *Aviation Week*, March 13, 1978. Also see the section on engines in *Jane's All the World's Aircraft*.

[28] *World Armaments and Disarmament*, SIPRI 1978 yearbook, London, Taylor and Francis, 1978 pp. 445-454.

[29] *Tactical Nuclear Weapons*, especially pp. 40-49.

[30] Thomas C. Schelling, *Arms and Influence*, New Haven, Yale University Press, 1966, pp. 170-184.

[31] All costs are expressed here in 1976 U.S. dollars in an attempt to cope with unpredictble and variable inflation rates; cf. the difficulties encountered by SIPRI in comparing arms budgets in the 1978 yearbook.

[32] For comparison, the cost of new nuclear artillery shells for the U.S. 155-mm and 8-inch guns in Europe was estimated to be about $400,000 each in the early 1970s. See *Tactical Nuclear Weapons*, p. 55. The inference there was that material cost was dominant. Of course, the small programs considered here do not achieve the economies of scale of large U.S. or Soviet plants. Uranium shells were estimated at about 1 million dollars each for the same weapons. Ibid., p. 230.

[33] Dwight H. Perkins, "Asia's New Economic Environment," *Bulletin of the Atomic Scientists*, October 1978, pp. 11-18, discusses the relative technical abilities of several Asian states. However, he overestimates the total cost of a modest nuclear weapon program.

NORTH-SOUTH RELATIONS IN A WORLD OF MANY NUCLEAR POWERS

Klaus Knorr
Woodrow Wilson School of Public
and International Affairs
Princeton University

ABSTRACT

The less developed countries of the "Southern Hemisphere" are confronting the highly industrialized states of the "Northern Hemisphere" with redistributive demands of a political, military, and economic nature. The world of the South no longer wants to be dominated militarily by the great powers of the North, insists on complete autonomy, and asks for substantial changes in the international economic order.

On the assumptions prescribed for this paper, it is estimated that the spread of nuclear weapons to the South by the early 1990s will probably help the Third World—even though not in direct and obvious ways, and not spectacularly—to achieve in part all of these goals.

While the great industrial powers will remain, in absolute terms, far superior in military capabilities (as reflected in their share in world military expenditures), nuclear proliferation will add to the relative international shift in the distribution of military forces that has recently taken place with reference to modern conventional armament. Countries of the South will obtain little credible deterrence—and no power of compellance—as long as rational decision-making prevails, but a number of factors are likely to make the great powers less disposed to intervene militarily, and make them more disposed to decouple themselves from entangling alliance commitments, in the Third World. Both developments would increase the autonomy of the South.

Nuclear arms, except perhaps in the hands of terrorists, will not be used, even for purposes of serious threat-making, in support of economic-order demands. It is possible that nuclear proliferation in the South will have consequences disrupting to its unity on NIEO, and thus prove counter-productive.

Yet indirect effects will probably work in the other direction. These are: Northern concern about the possible emergence of nuclear terrorist movements; the ability of the South to create economic disruptions undeterred by any Northern threats of military reprisal; the demand for economic concessions in exchange for arms control schemes desired by the industrial world; and the perceived interest in Northern states to foster, in a highly interdependent world, a modicum of global order by supporting stability in the Southern hemisphere.

I. INTRODUCTION

The purpose of this paper is to speculate on how the emergence, by the early 1990s, of a substantial number of additional nuclear-weapons states, many of them LDCs, might affect the global relationship between the highly developed countries of the "North" and the less developed states of the "South." While the "North" generally is meant in this context to include all the industrialized countries, including the USSR and the communist states in Eastern Europe, in this paper we will refer to the industrial and more or less capitalist and democratic countries—often also referred to as the "West"—when speaking of the "North." The reason is that the demands of the South for a new economic order are directed entirely to this set of states. The South's demand for freedom from unwanted military interference is, to be sure, directed to the Soviet Union as well. However, even in this area of concern, the world of the South as a whole is, because of past experiences, somewhat more anxious about future threats from the West than from the USSR. When speaking of the "South," we will be referring to the LDCs or to the Third World to which nearly all LDCs belong.

II. THE NORTH-SOUTH CONFRONTATION OF THE 1970s

It became increasingly clear during the 1960s and 1970s that the LDCs were in full revolt against the existing international political and economic order. They regarded this order as a legacy of the past imperialist and, more latterly, neo-colonialist dominance of the capitalist powers, and the vast North-South disparities in international power and wealth as fundamentally unjust. In the economic area, the immediate and concrete demands of the South were: more stable and higher prices for the raw materials and foodstuffs exported by the LDCs, freer access for their industrial products to the rich markets of the North, the rescheduling and reduction of Third World debts, financial aid without strings attached, and recognition of their sovereign rights to regulate and, if desirable, nationalize foreign multinational corporations. The South also pressed for a larger share in the authority over decision-making in critical international institutions, such as the IMF, the World Bank and GATT, so that, in the future, it would not have to depend on Northern concessions on substantive issues but could ensure a better deal as a result of shared authority.

In the political and military areas, the Third World wanted not only to eradicate the few remnants of formally colonial structures, but also to bring an end to the politico-military dominance of the great industrial powers in particular regions and in the world as a whole. To be at the mercy of the great powers and their interventionary proclivities was no longer tolerable. Consolidation of LDC independence and autonomy required Northern, including Soviet, use of military force to be curbed and global North-South disparities in military strength to be diminished. The LDCs resented being treated as mere objects of arms control, as in the Non-Proliferation

Treaty (NPT), and being used as pawns in great-power rivalry. The vast majority of Third World states adhered to a posture of non-alignment in the East-West confrontation even if some of them, facing grave security problems within the Third World, sought protection from Northern patrons. Finally, the countries of the South opposed the preoccupation of the North with the East-West conflict and insisted on a reorientation of world politics that would make it center on the issues turning on the North-South axis.

In the eyes of Third World elites, the military, political, and economic issues that united the South against the North were closely interlinked. Military security from great-power aggression and political autonomy, on the one hand, and economic improvement, on the other, depended on one another. Despite the recent growth of international interdependence, however, the Third World was not out to revolutionize the basic organization of the international system that rested on the sovereignty of individual states. The LDCs did not clamor for a change *of* this system. On the contrary, they wished to make their separate sovereignties real in terms of independence. Toward this end, they required changes *in* the system that amounted to a radical international redistribution of world resources, and of the welfare and influence which the possession of these resources tends to generate.

By the second half of the 1970s, the industrial capitalist states of the North had begun to meet with the LDCs to discuss specific demands for a new international economic order (NIEO). The OPEC countries had greatly and abruptly raised their share in the world's income and wealth and acquired some considerable economic leverage over the oil-importing nations of the North; and a small number of other LDCs were making rapid progress in industrialization. The South was greatly increasing its share, even if absolutely speaking still very small, in global military expenditures and imported large amounts of modern armaments from the North. Soviet-American animosity and rivalry tended to restrain military intervention by either great power in various parts of the Third World. Moreover, political constraints—largely the aftermath of an unfortunate military intervention in the Third World—had sharply reduced the disposition of the United States to become militarily involved in the affairs of the South. Compared with only a decade earlier, some diffusion of international power and influence was definitely in train.

Yet the South remained deeply dissatisfied in its challenge of the privileged North. In terms of income per capita, most LDCs were making little, if any, headway toward closing the glaring gap in the distribution of the world's economic product, and many of them were stuck in abject poverty. The North had proved unwilling to grant significant economic concessions to the South. The disparity in military force structures continued to be vast and threatening. And though the global military strength of the United States remained shackled, and also declined relative to that of

the Soviet Union, it persisted in its attempts to counter Soviet influence in the Third World. American attempts to raise universal issues with reference to human rights, control over the arms trade, and the proliferation of nuclear weapons were regarded by most Third World nations as irrelevant or inimical to their aspirations.

Why had the South failed to achieve more decisive advances in line with its collective demands on the North? This question is important in view of the purpose of this paper because it touches critically on the ultimate question of whether the postulated spread of nuclear armaments in the Third World is apt to make a difference in the North-South confrontation.

The general answer to the preliminary question is obvious and banal. The weak always tend to find it hard to wrest significant changes in the status quo from the strong. Caught in this situation of inferiority, the South, during the 1970s, nevertheless had appreciable assets on which it could draw in addressing the North.

(1) There were plenty of forums, especially those provided in the complex structure of the UN, in which the South could voice its demands, and it could marshal huge voting majorities in those forums according equal votes to member states. At the very least, these displays had considerable nuisance value vis-a-vis the Northern countries.

(2) The OPEC countries had secured sufficient command over financial resources, as well as economic leverage, over the oil-importing nations of the North to have their wishes taken seriously by the latter.

(3) For a variety of reasons, after the 1950s the industrial states of the West no longer enjoyed the influence in the Third World they had easily derived from greatly superior military strength before World War II. The larger European states and Japan ceased to be significant world military powers, and the utility of force as a basis for dominating the behavior of Third World states had suffered a perceptible decline even in the case of the superpowers. Cheap gains were no longer obtainable from the application of force.

(4) The LDCs were able to withhold cooperation on issues—such as problems of environmental protection, the laws of the sea, and the prevention of nuclear proliferation—that mattered to the North.

(5) The ability of the Third World to play off the Second against the First World—which was one reason for the improved security from the superior military strength of the superpowers—was also useful in confronting the industrial capitalist

nations ideologically and politically. The Third World could usually count on the backing of the Communist states, especially the Soviet Union and China.

(6) Among significant elite groups in the capitalist North, especially those in government bureaucracies, news media, and the universities, there was growing concern with the economic plight of the LDCs and a normative identification with their cause. In the 1970s, this sympathy—more developed in some countries (e.g., the Scandinavian countries, the Netherlands and England) than in others (e.g., the United States and West Germany)—was perhaps the most important base of influence enjoyed by the South. It produced a potential readiness to bargain seriously and to compromise.

(7) Partly as a result of the development mentioned under (6), the countries of the North became less united in facing Southern demands. On the other hand, the South as a whole remained remarkably unified, particularly with reference to demands for a new international economic order.

However, while the South was able to muster enough influence to be listened to by the governments of the North, it evidently was not enough to be translated into the kind of change in international order and relations on which LDC elites had set their minds. The North was able to stall, and the South remained correspondingly frustrated. By the late 1970s it appeared that meaningful progress toward the South's objectives would depend primarily on a further strengthening of Northern sympathies with the misery of backward countries and with the normative challenge of the South, abetted perhaps by Northern considerations that the prosperity of the Third World had become a condition for a resumption of their own economic growth. The importance of the other assets that the LDCs could bring to bear in their struggle for a new international deal had waned. In fact, there were signs that the solidarity of the South was under increasing strain. The problem of Southern cohesiveness in putting pressure on the North is of interest because it is likely to affect our speculations about North-South relations in the early 1990s.

Throughout the 1960s and the first half of the 1970s, leaders and elites in the Third World had been keenly aware that cohesion in confronting the capitalist powers was a crucial precondition of eventual success. Because the Third World is, despite certain common experiences, very heterogeneous in political, economic, and cultural respects, solidarity vis-a-vis the North would not be easy to maintain. In order to fashion and preserve unity, Third World leaders formulated demands against the North that encompassed all proposals for change, including the most extreme. To present the North with a program responsive to the most moderate, as well as the most malcontent, of LDCs was no problem as long as the voicing of demands exhausted

itself on the rhetorical level; that is, as long as the North was unprepared to negotiate in earnest. Any serious bargaining was likely to reveal differences of national interest among the LDCs. The OPEC states and some other LDCs (e.g., Brazil, South Korea, Singapore) were doing economically so well in the existing economic system that they might be satisfied with relatively moderate reforms, while other countries of the South (e.g., India, Pakistan, Egypt, Zambia, Peru) remained more or less mired in economic backwardness and, especially in view of heavy population growth, achieved unsatisfactory rates of economic development. Third World states also exhibited an only partly overlapping division between countries that were radical with reference to demands on the North (e.g., Algeria, Libya, Iraq and Nigeria) and others whose expectations were comparatively moderate (e.g., Brazil, Morocco, Saudi Arabia and Malaysia). These divisions were significant enough to make the future solidarity of the South problematic.

III. NORTH-SOUTH RELATIONS IN THE EARLY 1990s

A. The Demands of the South

The topic assigned to this paper assumes that, more than a decade later, the demands of the Third World as a group on the North remain unappeased. This might happen either because concessions by the industrial North were insufficient to meet the original demands of the South or because the South had raised new demands for redistributive action designed to benefit its economic development, welfare, and autonomy. Two alternative subsidiary assumptions seem possible at this time.

Assumption A: The relevant situation in the early 1990s is essentially what it was in the middle 1970s. The bases of Third World influence did not appreciate during the intervening years. The nations of the North were willing and able to resist the major demands of the LDCs and made only gradual and insignificant concessions on economic matters. The division of the Third World between economically successful and unsuccessful states, and between countries favoring a radical or moderate challenge of the North, changed very little, as did the identity of states in each category. It can be assumed under this alternative that the economically well-off and moderate states had become even more inclined to pay little more than lip service to the challenge of the South and that some of them (e.g., Iran and Saudi Arabia) continued to require American backing for military security, while others (e.g., Ethiopia, India and Iraq) leaned on the Soviet Union in this respect. The radical members of the Third World had become increasingly embittered by the Northern refusal to satisfy their demands.

Assumption B: While the North had made some significant concessions in modifying the international economic order, the Third World is now agitating not

only for Northern adoption of the remaining original proposals, but also is making further redistributive claims involving market access; involving food, technology, and capital transfer; and—on the grounds that capitalist populations are occupying a grossly unfair proportion of land—involving an opening of Northern territories to immigration from the South. At the same time, a number of rich and successful countries of the Third World had defected from the ranks confronting the industrial North and had associated themselves with the existing political and economic order. The large majority of malcontent LDCs, however, had become more radical and cohesive in confronting the capitalist North and were strongly backed by the main Communist powers in terms of propaganda, diplomacy, and threats against any attempts by the North to intervene militarily in the Third World. Moreover, some countries of the South that had become enriched and/or were conservative in their expectations of Northern concessions during the 1970s had, by the early 1990s, become radicalized as a result of internal revolutionary coup d'etats. This could have happened to Iran, Saudi Arabia, Egypt, and others.

The new radical coalition would, in principle, oppose any great-power military intervention in the Third World, especially interventions motivated by great-power competition for influence globally and in particular regions, or military intervention in response to the request of a distressed government in the South and attracted fairly widespread tolerance or approval in the Third World. But this opposition would be more intense in the case of the United States than in the case of the Communist great powers. We may indeed assume that this Third World sensitivity had been a factor in the failure of the North to stem the proliferation of nuclear-weapons states. The spread of such arms to the South may well have been perceived by Third World leaders and elites as a development that would reduce the military superiority of the superpowers or, if technically not quite that, to diminish the utility of Northern military superiority.

The task set for this paper also assumes that there has been little change in the strategic relationship between the United States and the Soviet Union. It follows that there has also been little change in East-West relations in general, that a basic hostility or wariness persists despite limited cooperation. Even if the South remains more apprehensive of American than of Soviet military intervention on behalf of self-serving goals, the USSR is part of the relevant "North" when it comes to Southern insistence on freedom from imperialist or neo-colonialist exploitation of Northern military superiority. This imbalance of suspicion could change if the United States abstained from any such moves over an appreciable period of time while the Soviet Union continued to exercise its growing interventionary capabilities under circumstances that generated suspicions about its motives. On the other hand, there is little chance, during the envisioned time span, that the Soviets would also figure significantly in Southern economic demands. The Soviet share in international trade and world

monetary affairs will remain too small to permit an appreciable impact on the international economic order. It can be taken for granted, however, that the Soviets—in any case dedicated to the downfall of the capitalist order—will continue to support the economic demands of the South against the capitalist North. The PRC can be assumed to do the same thing even if the Soviet-China split persists unabated.

B. The Military Significance of the Spread of Nuclear Arms

We assume that, by the early 1990s, a substantial amount of nuclear weapons proliferation has taken place in the Third World and that the current and presumably continuing transfer of various arms technologies from the North to the South permits the acquisition of delivery systems which, even if far from comparable to those deployed by the superpowers in accuracy, reliability, and range (let alone varieties and numbers), makes them technically usable in local and regional conflicts between Third World countries. We assume, furthermore, that their actual use—on which threat-making depends—against states of the North cannot be excluded *on technical grounds*. Depending on precise geographic circumstances, delivery would certainly not be prohibited by limitations of range against territories, extra-territorial military bases, and force concentration (e.g., naval) of industrial states that are within regional confines. And even though the range of usability would tend to decrease over larger distances, inter-regional delivery by long-range aircraft or surreptitiously by surface ship, or in other ways, cannot be ruled out on technical grounds.

These technical possibilities, however, do not ensure a military capability for issuing credible nuclear threats against the North. The two superpowers may well possess offensive capabilities permitting preemptive disarming strikes against LDC forces, and defenses that make effective penetration of their homelands extremely difficult and unlikely. Even if they could not hope to be completely invulnerable to considerable local damage, they would be able to devastate an attacking LDC in a retaliatory blow. The expected imbalance of destruction would serve to deter any rational decisionmaker in the South from initiating nuclear war against a superpower. This means that nuclear Third World states would remain without any power of *compellence*. They could not make a superpower do anything positive by threatening a nuclear exchange. Threats of nuclear *deterrence*, however,—that is, the ability to restrain a great power from committing a hostile act—would be somewhat less incredible. Nor can completely rational decisions be counted upon. There are degrees of rationality and irrationality in the real world. To be sure, an LDC under superpower attack, even a conventional attack, would still face the prospect of a disproportionately damaging counter-attack if it resorted to a nuclear strike against the homeland of the superpower, or even against superpower bases and force concentrations in the region. But the government of the superpower could not be sure

that a desperate LDC leader might not make the "irrational" decision to hit back. And a rational response to this cautioning uncertainty would have a degree of deterrent value. Moreover, even if a nuclear LDC threat against states of the North that are lesser nuclear powers or lack nuclear forces would not be regarded as credible, absolutely speaking, it would be less incredible than that against a superpower unless such Northern countries were definitely known to enjoy complete backing by one of the superpowers.

There is one more potential nuclear threat that the North may face from the South. This would emanate not from LDC government actions but from terrorist champions of the South's revolt against the industrial North. Nuclear weapons proliferation in the Third World—where domestic rule is often feeble and politics turbulent, where government efficiency tends to be low and resources allocated to the safeguarding of nuclear arms may be inadequate, and where internationally active terrorists have attracted considerable support in the form of money, training, and supplies—can be assumed to increase opportunities for terrorists to steal or otherwise acquire nuclear weapons (possibly with the connivance of a government). The Third World also develops readily the human material for the recruitment of activists who are intensely dedicated to political causes and believe the fight for justice, as perceived by them, to legitimize the infliction of terror. It is not inconceivable, therefore, that such partisans will be prepared in the future to resort to nuclear threats in order to coerce the North into sweeping concessions to the demands of the South.

It may not be likely that such a threat will arise; but, if it does—and the possibility cannot be excluded—the terrorist threat could be more serious than the nuclear threat emanating from any LDC government which has come into possession of nuclear armaments. This would be so because defense against small and anonymous terrorist groups is difficult and, above all, because they do not offer a target for a deterring retaliatory nuclear threat.

The extent, even though estimated as small, to which nuclear-weapons states of the South may present a military problem to the North depends on whether the LDCs involved will be conservative or radical in their attitudes toward the industrial states. It is generally thought that the decisions to go for nuclear arms will be determined primarily by local and regional security needs or military ambitions, and this incentive is apt to operate with either set of LDCs, although in conservative countries, the strength of this incentive will be affected by the confidence they derive from any security arrangements with Northern powers, especially the United States, and, in this case, also the USSR. In addition to incentive, proliferation depends, of course, on possession of a suitable technological and military infrastructure. This endowment will have been developed for the most part by the larger OPEC states and by other LDCs

that have experienced rapid industrialization and large imports of modern military equipment from the North, including the Soviet Union. During the 1970s, many of these states (e.g., Saudi Arabia, Iran, Egypt, South Korea, Taiwan, Brazil) were moderate in their demands on the North. But some of them were not (e.g., Algeria, Libya, Iraq, Nigeria) and—on our alternative Assumption B—some of the moderates could turn radical by the early 1990s.

C. Military and Political Implications for North-South Relations

The foregoing analysis suggests that for three reasons the further spread of nuclear weaponry to the Third World will bring changes in international relations that are in line with the demands of the South on the North.

First, the potential terrorist threat aside, while the homelands of the North would hardly be subject to considerable military threats from nuclear arms in the Third World, uncertainties about the possibility of irrational and uncontrolled behavior in a crisis would render the North less inviolate than before, and the nations of the North would presumably be correspondingly more circumspect than they have been in challenging states of the South.

Second, these uncertainties would probably be more compelling in the event an industrial power intervened militarily in the world of the South. In particular, the possibility of nuclear reprisals by LDCs against Northern military bases and force concentrations in the area of conflict would make intervention somewhat more risky. One would expect as a result that intervention by force would become less likely simply because the Third World has become militarily more prickly. It is possible, furthermore, that the specter of nuclear terrorism would reinforce this disincentive. This constraint would not, of course, be absolute. But the values at stake in any conflict in the Third World would have to be correspondingly higher before the option to intervene would be regarded as suitable in the pursuit of national interests.

Third, it is likely under these circumstances that the great powers of the North would curtail alliance and patron-client commitments that entangle them in the disputes of a Third World that, after proliferation, has become more dangerous to operate in. This is not to say that such commitments may not be maintained in areas, particularly those contiguous to the territory of Northern states, where control remains desirable for bolstering the security of Northern homelands. Globally, however, superpower disposition to seek and preserve commitments designed to curb the influence of rivals could be expected to wane.

According to this assessment, the spread of nuclear weapons to the South would represent a further step in the diffusion of world military capabilities and in the

international patterns of influence that tend to be associated with them. Such a development would not necessarily mean that the welfare of the South would, in the net, be enhanced, for nuclear proliferation has also the potential of great destructiveness in South interrelationships. Yet the autonomy of the Third World vis-a-vis forceful interference from the North would stand to gain and this, as we have noted, is a major objective of the LDC world. Even if a substantial spread of nuclear arms, constituting new security problems for all states—South and North—evoked widespread desires for arms controls designed to diminish this new insecurity—a desire that might be evinced in the South as well as in the North—Third World states could now insist that they be treated as equals in these matters, and it would be surprising if the North would not heed this demand.

D. Implications Regarding Demands for NIEO

No matter how alienated the Third World might be from the existing international economic order, the spread of nuclear arms to countries of the South will have no direct effects on improving their bargaining position in pressing for redistributional changes. The use of nuclear threats on behalf of these goals would require power of compellence rather than of deterrence, and such power, as we have shown above, cannot be derived from the possession of nuclear capabilities, dwarfed by those of the North, as long as reasonably rational decision-making prevails. Suicidal bluffing would have no credibility in this context. No coalition, even of radical LDCs, could be formed for this purpose since it would presuppose grossly irrational governments in all participating states. The value of any economic gains that could be expected for the Third World as a whole would be disproportionately insufficient to justify the assumption of suicidal risks. Even a nuclear threat by one "mad" ruler would be extremely unlikely because successful blackmail would be so obviously improbable and because any NIEO gains accruing specifically to any one LDC would be uncertain and undramatic.

It is even possible that nuclear proliferation in the South would weaken the NIEO cause in one respect. As we have seen, LDC unity on NIEO is not basically as solid as it has been on the rhetorical level; and nuclear spread could have consequences apt to undermine this solidarity, certainly under Assumption A but conceivably also under Assumption B. Nobody can safely predict what the acquisition of nuclear weapons would do to Third World stability and cohesion. That world is full of acute and dormant disputes and tensions. It could nevertheless happen, at least in some areas, that a combination of favorable circumstances would result in stable situations of deterrence. It is also true that, in the past, the maintenance of a common front against the North proved possible among unfriendly members. At the present time, although Morocco and Algeria, Libya and Egypt, Syria and Iraq regard one another with considerable animosity, they remain effective members of the Group of 77. Yet an

increase in mutual fears and hostility could not help but diminish effective unity of purpose, and the spread of nuclear weapons would probably lead to this condition. It is hard to see that nuclear proliferation would reproduce generally in the Third World the degree of strategic stability which evolved in East-West relationships because situations of mutually assured destruction would be hard to replicate in many parts of the Third World. And if the cohesion of the South were to suffer as a result, which is far from impossible, the South's ability to challenge the North on NIEO would decline. Indeed, under worst assumptions of frequent military crises and perhaps catastrophic encounters in the Third World, and resultant chaos, that challenge would probably disintegrate.

Yet there are also possible *indirect* effects of nuclear spread that could be expected to help the economic cause of the South, provided Third World chaos is avoided. First, the emergence of a nuclear terrorist threat in support of NIEO goals would surely trouble authorities in the highly industrialized states, and make them more cautious in dealing with the South. Second, if they felt desperate enough on this issue, LDCs might decide to make all kinds of mischief, for example by putting disruptive economic pressures on the North, especially by utilizing whatever leverage is afforded by the control over oil exports and prices and, perhaps, over some other supplies of raw materials as well. This sort of action might not be very likely since, to adopt it, would be economically costly to the LDCs involved. But if they felt driven to such steps, they would not have to fear, under conditions of nuclear spread, that Northern states would be likely to respond by military reprisals.

Third, the states of the South might exploit any surge in Northern desires for global arrangements of arms control by making cooperation contingent on substantial NIEO concessions. Fourth, and probably most important, with the spread of nuclear armaments to the South under likely conditions of great turbulence in the Third World, and hence, with the enhanced prospect of nuclear war somewhere breaking out sooner or later, appalled Northern nations would probably experience a heightened sense of diffuse insecurity and perceive more sharply than before that, in a highly interdependent world, the large majority of the world's states and population could not safely be treated with benign—or not so benign—neglect, and that no reasonably tolerable approximation of world order would be feasible without far-reaching global consensus, including the consent of the Third World. Such troubled perceptions might well induce Northern governments to do all they could to promote stability in the South, and agreeing to serious negotiations on NIEO and salient concessions to the demands of the South, might well come to be regarded as an essential part of such an endeavor at global pacification. This is not, of course, a necessary response. The industrial powers of the North might instead prefer to seal themselves off, as best they could, from a disorderly and troublesome South. But it is extremely doubtful that the South could be placed in effective quarantine and that

isolation would work. Northern leaders would probably soon understand this. To foster and support, as much as possible in view of Northern domestic constraints, a global climate of restraint and moderation would probably seem to be the better bet. And such a course of action would argue for conciliatory and constructive measures in meeting the demands of the Third World for economic equity.

To conclude: The many LDCs that only recently emerged from colonial bondage, the achievement of formal national sovereignty has indubitably entailed benefits to the vast majority in terms of political and economic autonomy, and probably also in terms of economic welfare. It is our estimate that, in various ways, the strengthening of LDC military sovereignty, and the consequent diffusion of military capacity that would be increased by the spread of nuclear weapons, would probably benefit the South further in its political, military, and economic relations with the North.

IV. POSTSCRIPT

There is, of course, no way in which we can predict with confidence what the consequences of further proliferation of nuclear armaments will engender. All that we can do is to conjecture. Yet such estimates are very sensitive to the contingent hypotheses that are brought into play. The problem that was posed for this paper made the implicit assumption that, other than the spread of nuclear weapons to countries of the South, international relationships—and the national conditions on which these rest—will remain roughly the same by the early 1990s as they are now. This assumption is justified by compelling analytical concentration on the impact of one particular change in parameters. But it is clearly possible, and perhaps likely, that other major changes will have occurred as well and that alternative assumptions about these might affect the ways in which nuclear proliferation will impinge on North-South relations.

There is no room in this paper for extending the analysis in alternative directions. But it seems apposite at least to mention two other possible and rather extreme changes that would suggest different conjectures. First, by the early 1990s, the great Communist powers might dominate the capitalist West because the strategic nuclear balance between East and West has been upset in their favor, and/or because the Soviet-Chinese split has been repaired (if only in part and temporarily), and/or because the capitalist West has been profoundly weakened by the persistence of economic stagflation and its domestic political consequences. At the same time, the great Communist powers in cooperation with allied LDCs (e.g., Cuba) have also achieved substantial dominance over large parts of the Third World. NIEO demands on the West, now encompassing elements of Southern and Second World objectives, could then be backed by fairly effective coercive pressures, although hardly nuclear threats. Second, it is also conceivable that, by the early 1990s, the Soviet Union has

fallen prey to profound and semi-paralyzing domestic crisis, that Soviet-Chinese antagonism has become more severe, that the United States has recovered its international composure, that a resumption of steady world economic growth has induced a number of prospering LDCs to join the North, and that—as a joint result—the confrontational demands of South on North have become less effectual.

REFERENCES

Bull, Hedley, The Anarchical Society, *A Study of Order in World Politics*, New York: Columbia University Press, 1977.

Gompert, David, et al, *Nuclear Weapons and World Politics, Alternatives for the Future*, New York, McGraw-Hill, 1977.

Greenwood, Ted; Feiveson, Harold; and Taylor, Theodore B., *Nuclear Proliferation*, New York, McGraw-Hill, 1977.

Kothari, Rajni, "Sources of Conflict in the 1980's," *Adelphi Papers* No. 134, London, International Institute for Strategic Studies, 1977.

Rothstein, Robert L., *The Weak in the World of the Strong, The Developing Countries in the International System*, New York, Columbia University Press, 1977.

Wohlstetter, Albert et al, *Moving Toward Life in a Nuclear Armed Crowd*, Los Angeles, Pan Heuristics, 1976.

REGIONAL NUCLEARIZATION AND POLITICAL TENSIONS: SOUTH ASIA

Richard K. Betts
The Brookings Institution

ABSTRACT

The common assumption that nuclear proliferation will have a major destabilizing impact on regional political rivalries has yet to be demonstrated. Soviet, British, French, and Chinese proliferation did not increase the probability of war with their adversaries. The regional impact of proliferation will depend on the number of local proliferators, size and quality of their nuclear forces, intensity of their hostilities, sobriety of decision-makers, local standards of unacceptable damage, and evolution of the global-international system. The superpowers could determine the outcomes of local conflicts by intervening jointly or competing more vigorously in South Asia than they have in the past, but regional nuclearization is more likely to persuade the US and USSR to stay out of local squabbles. Then either stability would flow from multipolar nuclear deterrence in the area, or India would exercise hegemony in the region, or some combination of Pakistan-Iran-China alliances would be necessary to counter Indian power. Intra-national instabilities in the context of regional proliferation raise the salience of command-and-control arrangments, to deal with both "coup vulnerability" and the threat that secessionist groups might try to hijack nuclear weapons for their own purposes.

I. INTRODUCTION

Among Americans concerned with nuclear weapons there is a pervasive dread that proliferation would alter the international scene dramatically and for the worse, increasing political instability and the risk of nuclear war. Local conflicts that are now unfortunate for those concerned, but mere irritants to the rest of the world, would threaten to ignite wider and more cataclysmic disasters. Some Third World nationalists oppose this apocalyptic intuition and cite the stabilizing effects of nuclear deterrence, the tendency of nuclear capability to immunize states against coercion. In either case nuclear forces are assumed to have an impact—either radical or conservative—on the competition between nations. A third conceivable possiblity is that nuclear weapons will not materially affect international rivalries one way or the other; politics, diplomacy, and conventional military maneuvers will play themselves out as they have historically, while nuclear forces neutralize each other and old habits of strategic calculation persist. As Bernard and Fawn Brodie note of an earlier but equally significant change in military technology:

> "Although in our day it is a cliche that the invention of gunpowder hastened the end of feudalism and revolutionized the art of warfare, one forgets how slowly this revolution took place. . . . The soldier was tolerably well satisfied with the weapons he had, and he feared innovation. Monarchs were reluctant to increase their military expenditures and were generally appalled at the cost of new weapons. The tradition that it is ignoble to kill a man from a great distance continued to influence tactics for a surprisingly long time."[1]

This essay will explore the possible impacts of nuclear proliferation on traditional hostilities, focusing on the case of one region, South Asia, after postulating (in section 2) some of the limiting conditions of the character of such proliferation. But first it might help to introduce some general considerations by surveying what have been the impacts of nuclear proliferation on regional conflicts.

II. PRECEDENTS AND PREDICTIONS

Discussions of nuclear proliferation usually consider the phenomenon and thus as an eventuality of the future, as a topic of speculation rather than of research. Yet it has been occurring ever since 1945. The relevance of the lessons of past proliferation, for regions such as South Asia and situations where many states (rather than a minority) in an area have nuclear forces, may be limited. Of past proliferators, two (the United States and Soviet Union) have competed politically on a global rather than strictly regional scale, and two (Britain and France) developed their nuclear forces in periods when they had pretensions to worldwide roles. All but one of the countries (China)

that deployed nuclear weapons were also modern industrial powers. But this is not to say that the precedents are irrelevant. The central strategic issues to which nuclear forces were relevant revolved around one region: Europe. The Cuban missile crisis of 1962 was an extension of this central conflict more than a product of Caribbean-related rivalries. The other region in which nuclear weapons played a strategic role was East Asia, where US-Chinese antagonism—spurred by the unresolved territorial disputes from the Chinese civil war, such as the Taiwan Straits crises of 1954-55 and 1958—encouraged proliferation by China.

A crucial question for understanding the relationship of proliferation to future regional rivalries is to what degree nuclear military capabilities reflect or determine the hostilities between nations. Are nuclear forces the symptom or cause of conflicts? They are certainly the former; no state that lacked apparently threatening adversaries has yet acquired nuclear weapons. Nuclearization may also channel the evolution of national rivalries by changing the stakes, risks, and rules of the strategic game. But if the antagonistic states develop striking power to the extent that their respective nuclear forces serve only to "cancel each other out"—to deter use of nuclear weapons—diplomatic, political, and conventional military interactions may proceed in much the same way that they did before 1945. Thus Kenneth Waltz has argued that bipolarity, rather than the nuclear revolution, accounted for the failure of the cold war to become hot.[2]

Nevertheless, nuclear weapons afforded the United States an advantage in confronting the Soviet Union for almost two decades of the cold war, compensating for what was perceived as hopeless inferiority in conventional military forces. Most pointedly in Eisenhower's massive retaliation policy, the official US stance assumed an exploitable military and political utility in nuclear superiority, based on the threat of first-use. Only in the 1960s did policy shift to acceptance of mutual vulnerability, and the view that the Soviet threat to Western Europe needed to be countered in traditional terms with comparable conventional forces. Since then, doctrine for use of theater nuclear weapons, and the latent threat of uncontrollable escalation of conventional war to the nuclear level, has constrained the strategies and choices of actors in the NATO/Warsaw Pact rivalry, even if the nuclear variable has not changed the basis of the conflict itself. Would Stalin have caved in on the Berlin blockade in 1948-49 rather than escalate if the United States had lacked nuclear weapons? Would Washington have so easily accepted the Soviet pacification of Hungary in 1956 if the USSR had no nuclear deterrent? The answers are at best uncertain. Moreover, since decision-makers considered resorting to nuclear weapons in several cold war crises, there is little reason blithely to assume the immutability of stable mutual deterrence in situations of large stakes, high stress, and imbalanced forces.

How did proliferation by Britain and France affect hostilities in Europe? Indirectly at best. These countries' nuclear forces had negligible impact on the strategic balance between East and West (although General Gallois would not agree), and they did not affect the essence of the conflict as much as the confidence of the British and French in their ability to maintain the anti-Soviet stance that predated nuclear acquisition. By 1958 the British government was justifying its six-year-old nuclear force less by strategic than by political criteria.[3] There is also no clear evidence that British nuclear capability, or the absence of French nuclear weapons, affected the unfolding of the 1958 Berlin crisis, or that French inauguration of a nuclear defense program had any impact on the crisis of 1961-62. Whatever effects there were involved European resolve more than Soviet policy. American aloofness in the 1956 Suez fiasco, when Khrushchev issued nuclear threats against London and Paris, and the decline in credibility of the coupling of US strategic forces to European defense as Soviet intercontinental striking power took shape, fueled the British and especially the French perception of the need for autonomous deterrents.

Thus, proliferation in Europe was more significant for the regional entente than for the regional rivalry. For the British it helped solidify the Atlantic relationship and for the French it helped weaken it, offering an alternative to full dependence on American support. Even if the *force de frappe* was not strategically viable vis-a-vis the USSR, "it stiffened the backbone of the French bureaucracy. Many senior officials. . . apparently believed that the French nuclear force increased their government's freedom of action, and gave (or should have given) France something of a preferred position in the world, especially in Europe. Such beliefs, collectively held throughout a bureaucracy, can become something of a self-fulfilling prophecy."[4] Nuclear weapons facilitated DeGaulle's initiatives to counter American dominance and toward detente with the Russians in the mid-1960s, and even underpinned a vision of Franco-Soviet continental condominium to contain Germany—an idea aborted by the 1968 invasion of Czechoslovakia.[5] To this extent it appears that if nuclear proliferation had any impact on traditional cold war antagonisms in Europe it was—albeit only briefly and tentatively—to soften them.

China's acquisition of nuclear weapons in some ways resembled France's. Doubts about the reliability of Soviet support against American coercion were probably spurred by the Taiwan Straits crises of the 1950s, and the appeal of a nuclear deterrent could only have been enhanced as the Sino-Soviet split emerged full-blown after 1960. Yet, it is not clear how substantially China's nuclear status has affected its involvement in Asian conflicts. Lack of nuclear weapons did not deter Chinese intervention in Korea. Chinese acquisition of nuclear weapons did not deter American escalation in Vietnam from 1965 to 1968. (US tactical restraint, in bombing, targeting and proscribing invasion of North Vietnam, was due to apprehensions about conventional

Chinese intervention.) Nor is it probable that China without nuclear weapons would have been attacked by the USSR. The Soviets could see that chastising China would not be as easy as invading Hungary or Czechoslovakia. The only rumored instance of some sort of Soviet consideration of military action was that provoked by Chinese development of nuclear forces.[6] Nevertheless, Soviet potential for political coercion would certainly have been higher in the absence of a Chinese nuclear counterthreat. And it is evident that Chinese nuclear weapons figured significantly as early as 1967 in the thoughts of Richard Nixon,[7] whose initiative to Peking dramatically altered international relations by inaugurating "triangular" diplomacy.

British proliferation tends to support the proposition that nuclear spread has relatively little impact on local rivalries. Hostilities in Europe have been hardly affected by the UK's nuclear status. French and Chinese proliferation tend slightly more to support the argument that nuclear multipolarity increases stability by reducing the ability of nuclear powers to coerce their rivals. Nothing in the record of proliferation to date, interestingly, proves the assumption that the process makes the world more dangerous by increasing the risk of war through escalation of local conflicts. There is little if anything to suggest that the volatility of hostilities in Europe or Asia during the cold war would have been lessened by the absence of nuclear weapons. This lack of historical proof for the pessimistic prognoses about proliferation, however, should not be overly reassuring. The observable patterns of interaction between the present nuclear powers cannot necessarily be extrapolated to other regions where antagonisms, traditions, and leaderships differ, and especially in a world where widespread proliferation (by twenty or more states) has occurred. This would be a world so different from the one in which nuclear forces first developed that more variables and possibilities need to be taken into account.

III. VARIABLES, POSTULATES, AND ALTERNATIVES

The fundamental question is whether nuclear proliferation will (1) lead to greater danger, by intensifying and widening local rivalries, or (2) enhance regional stability by moderating antagonisms or discouraging adventurism. The answer is a function of at least six variables:

1. Scope or extent of proliferation. How many and which states in the region have acquired nuclear weapons?

2. Quality or sufficiency of forces. How powerful and threatening are the stocks of weapons, and how protected are they from preemptive destruction by opponents?

3. Nature and intensity of the regional rivalries.

4. Sobriety and awareness of decision-makers. Do local leaders fully appreciate the capabilities and dangers of their own and their enemies' nuclear forces? How cautious or how prone to risk, brinksmanship, or recklessness are they?

5. Local criteria of unacceptable damage. Robert McNamara assumed that deterrence by the threat of assured destruction required the capacity to destroy about a quarter of the Soviet population and half of Soviet industry in a retaliatory strike. Third World nuclear forces may not have such a capacity against their opponents. How sensitive will local leaders be to the prospect of substantial but lower levels of loss?

6. Evolution of the global-international system. How much, and in what ways, will external powers impinge on the dynamics of the regional subsystem? How independent are regional national interactions from the policies of other major powers?

There are so many permutations and combinations of the first three variables that it makes sense for the sake of analysis to stipulate arbitrarily the capabilities and the rivalries at issue. For the last two variables, a few alternative possibilities will be considered.

My analysis assumes that Pakistan will have a modest nuclear force, threatening only to India—perhaps 50 to 100 fission weapons of 50 kilotons or less, deliverable by aircraft or ship-to-shore missiles, partially vulnerable to preemption but still secure enough to constitute at least a finite deterrent in the perceptions of most observers. India and Iran will have substantial forces—more diversified, survivable, and threatening to any of the countries involved in the region. China will have capabilities that are massive by local standards, superior to those of any involved nations except the United States or the Soviet Union. Afghanistan, Bangladesh, Sri Lanka, and Nepal will remain non-nuclear.

The most critical variable for this analysis is the third on the list, the complex of regional rivalries. There are a number of long-existing antagonisms in South Asia and its periphery that could be affected by the advent of nuclear weapons. The most salient of these are international conflicts, principally irredentist territorial claims by Pakistan against India (over Kashmir) and Afghanistan against Pakistan (over "Pushtoonistan"). There are also intranational tensions such as secessionist movements in Pakistan (Baluchistan) and India (Assam). Finally, there are conflicts with transnational overtones in addition to domestic aspects, such as communal or confessional hostilities between Hindus and Moslems or between Moslem fundamentalist zealots and secular modernists. On the latter count, for instance, fundamentalists of different varieties have recently challenged one regime from below (in Iran) and have taken control of another regime from above (in Pakistan).

New bases of conflict may well arise in the region by the time widespread nuclear proliferation has occurred, but it would be a shot in the dark (and this subject is already murky enough) to try to specify what they will be. In any case, the old bases of tension are likely to endure for quite some time. Moreover, current antagonisms would be consistent with future proliferation. Unlike some other regions, in South Asia it is not necessary to postulate major political changes or increases in tension in order to make resort to nuclear weapons programs more plausible. I will, therefore, assume that most current territorial disputes will remain unresolved (otherwise it is difficult to see what would logically impel the proliferation process itself) and that communal hostilities will continue (ethnic and religious contentions are less tractable than international alignments and less susceptible to solution in a short time span, such as one generation).

The fourth variable on the list, leadership "sobriety," may be one of the most critical. The mainstream of deterrence theory has tended to treat this factor as a constant, assuming rational strategic calculations on both sides of any nuclear equations.[8] This has not precluded analyses of the possibilities of bluff and risk manipulation,[9] the utility of uncertainty or threats of irrational retaliation for reinforcing mutual deterrents,[10] or the technical and psychological limitations obstructing carefully premeditated and orchestrated employment of nuclear forces.[11] But rarely have the implications of possession of nuclear options by irrational, ignorant, stupid, or fanatical leaders been considered, other than by parenthetical scare references to nuclear-armed Qaddafis or Amins.

There are intermediate possibilities where the chances of miscalculation rise. For one thing, the simple arithmetic growth in the number of nuclear decision centers increases at least slightly the odds that a mistaken leader will use or provoke the use of nuclear weapons in a crisis. For another, it is conceivable that in a world where nuclear weapons have become commonplace they may seem a bit less awesome and the intricacies of deterrence stability less demanding of intense study by political authorities. Finally, the occasions for miscalculation or rashness may be more numerous in a region with more volatile rivalries and more imbalanced strategic equations (in terms of nuclear and conventional military capabilities) than they have been in Europe.

Figures 1-3 suggest crudely the possible interrelationships of decision-makers' attitudes or propensities to take risks with the variables of military nuclear strength and national hostilities. "Sober" leaders are those who rationally pursue national interests, have a clear appreciation of strategic realities, and are willing to take calculated risks when the odds are substantially in their favor (akin to what is traditionally conceived as Realpolitik behavior.) "Timid" leaders are those averse to almost any risk, and willing to subordinate interests to caution even at high cost

Figure 1

FORCES, HOSTILITIES, LEADERSHIPS, AND STABILITY

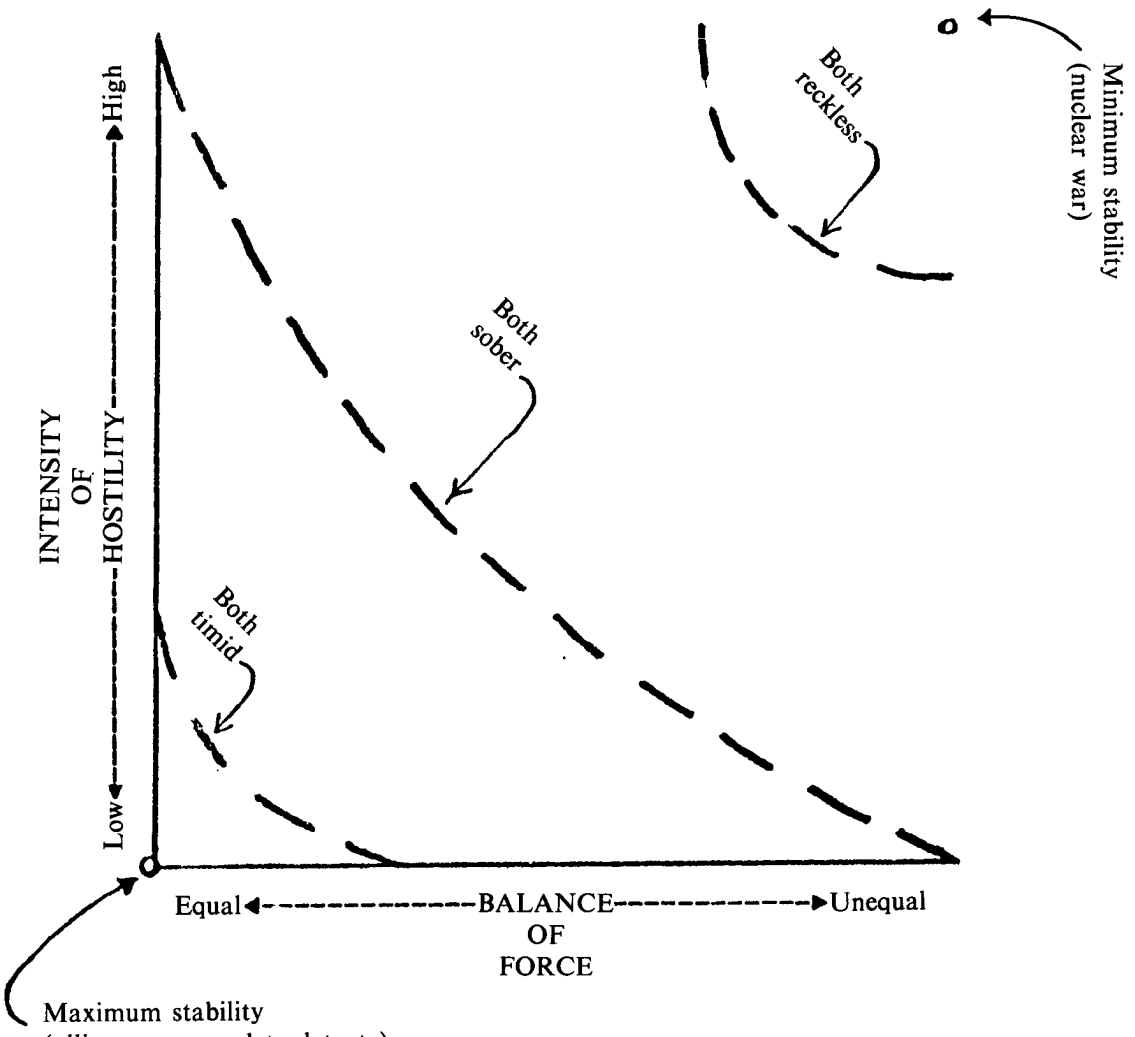


Figure 2

MILITARY STABILITY *

Weaker \ Stronger	R	S	T
R	9	7	8
S	5	4	6
T	3	2	1

* Probability of use of nuclear weapons.

Figure 3

POLITICAL STABILITY **

Weaker \ Stronger	R	S	T
R	6	4	3
S	8	5	2
T	9	7	1

1 = lowest probability
9 = highest probability
R = reckless S = sober T = timid (leaders)

** Probability of alteration of status quo.

("appeasers," in the colloquial and pejorative sense of the term.) "Reckless" ones are those who are willing to act aggressively even when risks are extremely high, and who may lack full awareness of what the risks really are (fanatics or high-rollers, akin to the popular image of Hitler as strategist). Leadership judgment aside, there should be some rough tendency for equivalence in survivable nuclear capabilities to reduce the risk of war, and intensity of antagonism to increase it; the former limits the probabilities of gain for either side, the latter increases incentives to gamble. In situations where opposing forces are imbalanced and rivalry is intense (see upper right quadrant of figure 1), leaders' propensity to risk becomes an even more crucial variable.

If decision-makers on both sides of a rivalry are timid, their nuclear weapons will have a moderating impact, irrespective of the other variables, since they raise the risks of conflict. Asymmetries in propensity to risk, however, may have different impacts on military and political stability (the probability of change in the territorial status quo through actions or agreements short of war). The former may be purchased at the price of the latter, as timid leaders make territorial concessions to more reckless leaders in order to avoid the possibility of nuclear war. This is most likely when timidity coincides with military inferiority and recklessness with superiority (see lower left box, figure 3). On the other hand, the nation with hypercautious decision-makers may not be pressed to surrender politically if its adversary is militarily inferior and governed by sober leaders who realize their lack of strategic leverage (see middle box, right column, figure 3).

The sixth variable, views of vulnerability to unacceptable damage, would probably vary roughly with leadership sobriety. A reckless leader in India might, under extreme conditions, calculate as "acceptable" the damage inflictable by Pakistani weapons that could survive an Indian first-strike and penetrate Indian air space; this would seem more plausible if Pakistani first-use appeared likely in the event of Indian forebearance. A sober or timid leader, on the other hand, would have to be pressed much further toward desperation in order to consider the prospect acceptable.

The possible interactions of these variables in South Asia are numerous, although probably not as many as the boxes in figures 2 and 3. Although there will almost certainly be significant disparities in the nuclear and conventional military capabilities of antagonists in the region, particularly India and Pakistan, and domestic instabilities leave open the possibility that dangerously mercurial or excessively chary leaders will rise to authority, there is little in the recent history of the area to suggest that national foreign policy decisions will not be made largely in the "sober" mode. Also, while future development of regional political and social rivalries are hard to predict with

any certainty, they are not as hard to predict as the accession of particular individuals to positions of decisionmaking authority. My analysis, therefore, will focus on the international system and the rivalries themselves; the variability and significance of personalities should be kept in mind but, except where otherwise specified, the assumption will be that national leaders operate as sober strategic calculators.

Finally, one relevant consideration is whether the "proliferated" world has evolved without any combat use of nuclear weapons, or whether the process has been punctuated by one or more uses or exchanges of nuclear ordnance. Any breakage of the post-Nagasaki taboo would certainly have a profound impact on perceptions, strategy, and diplomacy. It could galvanize more serious efforts toward disarmament, arms control, international organization, or defusing of strategic competitions, or it could fuel alarmism and paranoia that provoke much higher investments in nuclear deterrent power. The result is unpredictable and would depend on the particulars of the incident and a large number of other imponderables. My analysis assumes that no nuclear war has occurred by the time that India, Pakistan, and Iran have acquired their nuclear forces.

IV. REGIONALISM AND THE GLOBAL CONTEXT

The concept of regionalism is ambiguous. The term implies connection (of states in the region), and some degree of separation (between the region and other states). Useful definition of the South Asia region in geographic terms (usually considered to be the Indian subcontinent and Sri Lanka) depends on the dimension of connection or interraction concerned—economic, cultural, ethnic, linguistic, political, strategic. The issue of nuclear weapons makes the last two the central ones. The crucial regional international rivalry is that between India and Pakistan, which have fought three wars in the past three decades. In strategic terms, however, a number of other countries are involved. China, which has had an unresolved border dispute with India since the 1962 war, is the principal threat that determines Indian strategy, and has been a source of support for Pakistan. The USSR has provided support for India and Afghanistan—less for the former since Indira Gandhi's ouster, and more for the latter since the coup by Nur Mohammed Taraki. Iran has supported Pakistan's territorial integrity, especially since the 1971 war and partition, but has promoted economic linkages with India in recent years. The US armed Pakistan in the 1950s and supported it in 1971, but assumed a more neutral position in the 1965 war and a more pro-Indian one since Carter became President. Thus, the future roles of several of these countries could vary widely. To understand how the Indo-Pakistani rivalry will play itself out once both have nuclear forces, it is first necessary to speculate on the prospective constraints that may be imposed by these external powers, the US, the USSR, and Iran.

Potentially the most determining factor is the role of the two superpowers, which will depend on both their military capabilities and their policies. By the late 1990s it is unlikely that the United States will again be exercising the dominance it did in the 1950s as the only true global power, with massive preeminence in nuclear and (outside Europe) conventional power projection forces. Given present trends it is possible (though not probable) that the USSR might be the obviously premier nuclear power, but extremely unlikely it will have surpassed the US in projection capabilities. The best educated guess is that there will be something close to the overall parity that has been emerging.[12]

Even if this forecast about the superpowers' capabilities is correct it suggests little about what their policies in South Asia will be, that is, their willingness to attempt to use their capabilities in the region for either military or, more plausibly, political purposes. First, history so far does not suggest that South Asia ranks high on the list of regional priorities for either the US or the USSR. Second, in a nuclearized region there will be even more reasons for external states to tread cautiously. Third, the superpowers' strategic role (or lack of it) in the region will also depend on the overall status of their bilateral relations, which could be more competitive or more cooperative.

Unless the advent of widespread proliferation provokes the US and Soviet Union to join forces to try to exert greater control over the diffusion of power, or rebirth of the cold war at an unprecedented level of intensity leads them to compete for global influence at unprecedented levels of cost and risk, the highest probability is that they will tend to isolate the region from their military competition, continuing diplomatic and political involvement but being wary of anything more than that. US-USSR policies then would matter relatively little for the development of hostilities within the regional subsystem. In this case the pattern of conflict could evolve in several ways. One would be a condition of military and political stability reinforced by mutual nuclear deterrence among all the states (with indifference to or subordination of the non-nuclear local countries). Diplomatic maneuver and rhetorical sound and fury, competition for advantage at the margins, and occasional crises would be common, but the territorial status quo would be robust because of unwillingness of any part to go over the brink. Nuclear power would keep rival neighbors, as well as external powers, at bay.

This pattern of deterrance by "universally assured destruction" would resemble Morton Kaplan's "unit-veto system."[13] But, as Kaplan later noted, "the conclusion that the unit-veto system is stable is based upon the asymptotic form of the pure system. It does not take into account qualitative changes in weaponry or asymmetries in the qualitative arms race."[14] Assuming disparities in nuclear as well as conventional forces,

and lack of external support for the weaker states, the local rivalries might be submerged in a more hierarchical regional system,[15] with India at the top, Pakistan below, and Afghanistan and Bangladesh at the bottom. If the latter two have warm relations with India, as is possible since they have few bases of hostility, Pakistan might be at the bottom. This situation would be likely or stable only if Pakistan were governed by timid authorities.

Indian predominance, therefore, is quite likely under a number of alternative circumstances, and might not differ markedly in weight from the current distribution of power in the region. Pakistan's security might be bolstered above its current level by possession of a nuclear deterrent, but this increase might be counteracted by a weakening of Chinese support. Limited until now, such support might be eroded further by the extra prudence that an Indian nuclear force would inject into PRC planning. Aside from the superpowers the only other state likely to alter this situation would be Iran. If Iranian anxieties about Indian encouragement of centrifugal tendencies in Pakistan (which could spill over and, for instance, activate Baluchi separatism in Iran) abate, an Indo-Iranian condominium could emerge, protecting Pakistan but dispossessing it of any freedom of action. On the other hand, assuming Iran's continued concern for and strong interest in Pakistan's viability, an invigoration of a Tehran-Islamabad axis (at an extreme, including joint planning for nuclear targeting) might redress the imbalance of power between New Delhi and Islamabad. India would retain massive superiority in conventional military power, but would be outweighed in the nuclear dimension. If Peking did actively reaffirm its alliance with Pakistan—at one extreme forming an explicit triple entente with Iran—Indian feelings of insecurity could grow. Stability would then depend largely on the sobriety, particularly, of Pakistani leaders, and their refraining from any scheme to use the alliance and its collective nuclear superiority to pressure the Indians toward concessions; for example, a plebiscite in Kashmir. It is almost certain that Iran and China would prevent any such initiative. The balance of forces posed by such an alliance itself, however, woud probably induce New Delhi to seek closer ties with Moscow or Washington.

These possibilities imply that rivalries in a nuclearized South Asia could be pursued in ways similar to traditional balance of power politics, and that the nuclear factor would not revolutionize national interactions. But this is not more likely than the previous "unit-veto" alternative. More probable is a pattern somewhere between the two, where international political maneuver is not frozen, but initiatives for coercion are more discouraged and options more circumscribed than in a non-nuclear environment.[16] Although the regional balance of forces will be different from that between the nuclear powers of past years, and the national antagonisms not the same as those between the US and USSR (although the Kashmir issue is slightly analogous to the Berlin problem), this situation of limited constraint on traditional state behavior in

pursuit of national interests bears some similarities to the contest between the superpowers in the cold war. Thus, the ways in which the superpowers have sought to resolve or modify the conflict between them should be relevant to South Asia as well.

Regional arms control agreements—from a South Asian SALT and MBFR—are one possibility. The probability of stability flowing from such measures depends, however, on either Indian magnanimity or a tighter alliance of Pakistan with either Iran or China. The first would be necessary to allow any possibility of nuclear or conventional parity between New Delhi and Islamabad. (Recent Indian statements have denounced notions of "artificial parity" in the subcontinent.) The second, which would negate the possibility of the first, would be necessary to provide any inducement to India to come to terms.

Another possibility, which would facilitate arms control, would be a set of regional detentes. This would require either that some parties make concessions or resign themselves to the inevitability of the territorial status quo and agree to recognize ceasefire lines in Kashmir and the Sino-Indian frontier as permanent borders; Afghanistan would also have to forswear support for an independent Pushtoonistan.[17] This eventuality is probably no less possible than the East-West agreements on Berlin and recognition of both German governments that followed Bonn's *Ostpolitik* in the past decade, although indications have not been promising. Prime Minister Desai, perhaps the most pacific of both past and prospective Indian leaders, has had no disposition in recent years toward accommodation on Kashmir or the Chinese border.[18] Further passage of time might soften sentiments of one or more parties to the regional border disputes, and nuclearization might enhance the possibility of detente, based on recognition of current demarcation lines, by making the risks of any revanchist venture appear obviously unacceptable. But it is still possible that limited probing on these issues will remain an acceptable or even desirable option for the parties. As Stanley Hoffmann wrote of the strategic interactions of the nuclear powers at the height of the cold war:

> "In a world where the risk of total war is unacceptable, but where the very structure of the game preserves the possibility of total war, these powers oscillate between a policy of moderation motivated by the common desire for survival . . . and, on the other hand, a strategy that preserves the latent risk of war and periodically revives the real risk, a strategy motivated by the intensity of their rivalry and the need of each to prove that it will not sacrifice its security or its values merely to survival. This latter strategy consists, for example, in exploiting minor conflicts. The further a conflict is removed from the thermonuclear threshold, the more tempting and useful it may be as an instrument of foreign policy."[19]

V. IMPLICATIONS OF SUB-NATIONAL CONFLICTS

The antagonism between India and Pakistan will probably remain the linchpin of national conflict in a nuclearized South Asia. Under some circumstances a minor country like Bangladesh could be a dangerous catalyst of hostilities involving nuclear weapons. These circumstances might involve indirect precipitants from internal instability. Consider first that the odds that nuclear weapons would be used in combat are highest when a nuclear-armed nation's survival is threatened, and lower (though not negligible) in a very limited war. Even if a nation maintains a "massive retaliation" declaratory policy it is likely to implement a "flexible response" action policy if attacked by conventional forces. Thus, it is relevant that two out of the three Indo-Pakistani wars (and the 1962 Sino-Indian war) were very limited, involving low-penetration border incursions and early ceasefires. The exception was in 1971, when Pakistan was dismembered, and the occasion for the Indian liberation of Bangladesh was the civil war within that wing of the original country. Another such secessionist crisis in the region could be the most likely event to push a military conflict from the sub-limited to the survival level.

Bangladesh is still a far from stable state (within three years after the partition police had over 3,000 political killings on the books, with a larger number suspected), and could remain fragile beyond the advent of proliferation.[20] Revolutionary, autonomist, or secessionist movements could also revive in India (such as the Naxalites, or Naga and Mizo tribesmen), or Pakistan (Baluchistan and the North West Frontier Province). If such domestic instabilities do prevail, and are overlaid by continuing national rivalries, governments could be tempted to exploit civil fractiousness in their opponents by subversive alliances with centrifugal groups. Nuclear deterrence could channel this temptation more in the direction of covert action than conventional military confrontation.

Ongoing national strategic competition could also aggravate internal political instabilities. This happened previously in Pakistan where, following the 1965 war, Ayub Khan funded a military buildup from heavier taxes and reductions in social and developmental investments, and the austerity was extremely unpopular. More and more repressive measures became necessary to keep public order and eventually Ayub was toppled.[21] Unless Pakistan—financially strapped and highly indebted at present—receives much larger Saudi subsidies in the future, acquisition of a modest nuclear force could have similar effects. The only alternative would be financing the nuclear arm from cuts in conventional forces which might avoid negative impacts on domestic tranquility but make the regional strategic environment more delicate by compelling a Pakistani defense posture premised on early resort to nuclear weapons in the event of war.

Severe domestic instability could also catalyze intervention—for instance, India in Bangladesh, Pakistan in Afghanistan, Iran in Pakistan, or the Soviet Union in Iran—especially if the neighbor of the crumbling regime fears that that regime's nuclear weapons will fall into unfriendly or irresponsible hands. The most obvious issue raised by internal conflict is whether disaffected groups would want and be able to commandeer some part of the national nuclear force. Baluchis with a few nuclear weapons, for example, could not easily be pacified by the Pakistani government. This issue could also be a particular problem for India, because range problems in targeting China might prompt it to base nuclear forces in Assam, which is a very politically unstable area.

This raises the problem of command and control (C^2) mechanisms, which is relevant in two dimensions. In strategic national interaction C^2 is a major potential problem because weak nuclear forces developed on a shoestring by poor countries may face a tradeoff between viability and stability. The former might encourage launch-on-warning (LoW) postures (and with the short striking ranges between South Asian adversaries and modest surveillance technology that will probably be available to them, warning could be negligible) which would be inhibited by redundant and super-cautious C^2 procedures, and LoW is not conducive to confidence in robust mutual deterrence. Alternatively, a state might rely on clandestine insertion, "predelivery" of nuclear weapons. This is unlikely except for extremely adventurous coercive purposes rather than defensive deterrence, or if a subnational group got some nuclear weapons. If it became known that a state was considering the predelivery option, it might provoke a crisis or preemptive attack by the targeted state, or at least an authoritarian increase in social control, police activity, and arbitrary detentions in the targeted country as it attempted to minimize points of access.

Domestic fragility in the form of "coup vulnerability" of a government, on the other hand, might conceivably discourage unstable nuclear force postures because "the dictates of internal political stability and self-preservation are likely to foster among the leaders of these new proliferators a greater appreciation of the importance of tight command and control,"[22] although it would certainly provide other grounds for apprehension. Concerns about coup vulnerability would be most salient in states that have already suffered coups or military factionalism and intrigue. Here again, if history is a guide, the potential problem lies more with the weakest countries in the region such as Bangladesh and Afghanistan. Iran and India, likely to have the most potent and secure of the local nuclear forces, also exhibit the most consistent pattern of harmony within the military and subordination of the military to civil authority.

C^2 hypothetically could be enhanced in a praetorian polity by measures such as recruitment of a nuclear security guard from the chief executive's extended family, or

"screw-in activitating modules—kept secured in the safe of the prime minister's brother who is, 'coincidentally,' the strategic force commander. This sort of human reliability program obviates the need for the kind of sophisticated permissive action links employed by the United States."[23] This would not, however, satisfy the quick-reaction retaliatory imperatives of a weak nuclear force.[24] Thus the C^2 problem, the force postures that may flow from it, and internal political tensions in general, pose uncertainty about the number of potential fingers on a nuclear trigger, the assurances of restraint and caution that will govern decisions on nuclear use, and the anxieties and interventionary incentives, such as a situation may impose on more stable regional neighbors. Thus, in a nuclearized South Asia the notion of crisis stability developed by Western strategic analysts takes on a second, internal, dimension.

During the process of proliferation the potential for military instability (danger of war) may be lower than the likelihood of political instability (coercive changes of the status quo, such as redrawing borders) between nations, as the countries wth nuclear weapons possess compelling bargaining advantages over those without them. As the process becomes complete these odds may be reversed, as each nation feels immunized from coercion by virtue of its nuclear deterrent, but disparities in forces, domestic tensions, and simple multiplication of decision centers increase the chances of miscalculation.

Large-scale proliferation is probably at least fifteen years away. This makes it even harder to make any predictions with confidence, since new causes of local conflict may supplement or replace old ones, or rise from minor issues to major ones—for example, hostilities over water rights such as the Indo-Pakistani dispute about the Indus River basin.[25] In any case, nuclear proliferation is not likely to change the regional rivalries themselves (indeed it is most likely to occur because of them), but simply will change radically the stakes involved in playing them out. Whether proliferation tends to stabilize the region by frightening any country away from pressing claims against another, or tends to destabilize it by providing new tools for brinkmanship' blackmail or temptations to secessionist or other rebellious subnational forces, will depend most on the temperaments of national and factional leaders.

FOOTNOTES

[1] Bernard and Fawn Brodie, *From Crossbow to H-Bomb*, revised edition, Bloomington, Indiana University Press, 1973, pp. 41-43.

[2] Kenneth Waltz, "The Stability of a Bipolar World," *Daedalus* XCIII, no. 3, Summer 1964, pp. 885-886.

[3] Wilfrid Kohl, *French Nuclear Diplomacy*, Princeton, Princeton University Press, 1971, pp. 49-50.

[4] Donald Brennan, "Some Remarks on Multipolar Nuclear Strategy," in Richard Rosecrance, ed., *The Future of the International Strategic System*, San Francisco, Chandler, 1972, p. 16.

[5] Kohl, *French Nuclear Diplomacy*, pp. 139-147.

[6] *Washington Post*, February 18, 1978.

[7] Richard Nixon, "Asia After Viet Nam," *Foreign Affairs* 46, no. 1, October 1967, p. 122.

[8] "Rational" denotes value-maximizing adaptation of means to ends, and, given sufficient information, excludes counterproductive behavior.

[9] For instance, game theoretic approaches such as Thomas Schelling's *Arms and Influence*, New Haven, Yale University Press, 1966.

[10] This factor underlies arguments of some advocates of the pure form of mutual assured destruction, such as Herbert Scoville and Wolfgang Panofsky.

[11] See John Steinbruner, "Beyond Rational Deterrence," *World Politics*, XXVIII, no. 2, January 1976.

[12] I am betting that the US will respond to the current Soviet challenge in the nuclear realm and maintain rough strategic equivalence and that the Soviets will shorten the gap—still clearly in American favor at present—in global projection capabilities.

[13] Morton Kaplan, *System and Process in International Politics*, New York, Wiley, 1957, pp. 50-52.

[14] Morton Kaplan, "The Unit-Veto System Reconsidered," in Rosecrance, ed., *Future of the International Strategic System*, p. 51. "At the asymptotic extreme, the system has a tendency to approximate Hobbes's state of nature. Alliances are neither necessary nor helpful." Ibid., p. 49.

[15] Hierarchical in the literal sense, rather than Kaplan's.

[16] See Michael Howard, "The Relevance of Traditional Strategy," *Foreign Affairs* LI, no. 2, January 1973, pp. 261-265.

[17] The government of Afghanistan has suggested, on several occasions, creation of a Pushtoonistan entity that would include sections of what is now Pakistan. Tension between Kabul and Islamabad has fluctuated, with shooting between the two at times (as in May 1961), and a breach in diplomatic relations from 1961 to 1963. W. Normal Brown, *The United States and India, Pakistan*, Bangladesh, Cambridge, Harvard University Press, 1972, pp. 352-353. Circumstantial evidence suggests that the Taraki government will be even more sympathetic toward Pushtun autonomy. See Selig S. Harrison, "Nightmare in Baluchistan," *Foreign Policy* no. 32, Fall 1978, pp. 146-147.

[18] In 1969, he said Kashmir "is as irrevocable a part of India as any other State of the Union. There is no question of holding a plebiscite. . . . So the future of Kashmir is settled for all time: Kashmir is India. . . . If there is any problem of Kashmir it is that of the areas illegally occupied by Pakistan. These will have to be vacated. . . . So far as the areas occupied by China are concerned, I am definitely of the view that only when we get them vacated shall our relations with the Chinese be normalized. The Chinese in their present mood are not likely to understand any language except that of superior force." Quoted in Basant Chatterji, *The Mind of Morarji Desai*, Bombay, Orient Longmans, 1965, pp. 88-89. India's moralistic posture in international affairs does not imply that it will not be any less self-interested in its policies than any other state. Acquisition of a nuclear force might also soften the public significance of New Delhi's traditional promotion of disarmament. Even the proudly touted post-independence policy of neutralism can be interpreted as *Realpolitik:* "There is no basis for the view that the policies of a sovereign India during the 1947-62 period constituted a unique approach to national security distinct from the traditional one of power politics. Given India's geographical contiguity to the Soviet Union and China and her need for the greatest number of sources from which economic aid might be obtained, India's leaders opted for a policy of nonalignment toward the two power blocs." Lorne J. Kavic, *India's Quest for Security: Defense Policies 1947-1965*, Berkeley, University of California Press, 1967, p. 208.

[19] Stanley Hoffmann, *The State of War*, New York, Praeger, 1965, pp. 141-142.

[20] Francis R. Valeo, "South Asia: Report on Bangladesh, India and Pakistan to the Majority Leader," U.S. Senate Foreign Relations Committee Print, 94th Congress, 2nd session, 1976, p. 2.

[21] Wayne Wilcox, *The Emergence of Bangladesh*, Washington, D.C., American Enterprise Institute, 1973, p. 13.

[22] Lewis A. Dunn, "Military Politics, Nuclear Proliferation, and the 'Nuclear Coup d'Etat," *Journal of Strategic Studies I*, no. 1, May 1978, p. 31.

[23] Harold W. Maynard, "In Case of Deluge: Where Nuclear Proliferation Meets Conventional Arms Sales," unpublished paper, Los Alamos Scientific Laboratories, July 1977, p. 25.

[24] "If the new weapons state is opposed by other regional nuclear powers, provisions will probably have to be made for a more elaborate, redundant, and secure command and control network. This is necessary in order to ensure a coordinated response in case the enemy strikes first." *Ibid.*, p. 26.

[25] Roy L. Thompson, "Water as a Source of Conflict," *Strategic Review VI*, no. 2, Spring 1978, p. 69.

A NUCLEAR MIDDLE EAST

Geoffrey Kemp
Fletcher School of Law and Diplomacy
Tufts University

ABSTRACT

The introduction of indigenous or transferred nuclear weapons into local inventories of Middle East countries would raise numerous strategic problems that can be addressed only after specific force structures and weapons capabilities are defined. Thinking through the practical implications of a nuclear Middle East tends to support the argument that unless a country possessed nuclear forces of the approximate sophistication of Britain and France, the benefits might not be commensurate to the costs and risks. If this is the case, explicit discussions of a more nuclear world may help to debunk some of the myths that surround these weapons, and that, in turn, may make would-be recipients more hesitant to embark on such ventures. While an examination of the target systems in the Middle East reveals that a nuclear war—as distinct from the use of a single terror weapon—would have devastating effects upon all countries, consideration of the practical problems of initiating coordinated nuclear strikes throughout the area suggests that a nuclear Middle East, as distinct from a nuclear-capable Israel, may, in reality, be a long way off.

The political implications of these conclusions are very important. They suggest that perhaps the greatest benefits would accrue to a "potential" or "closet" nuclear power. In other words, the Middle East may confirm the proposition that the threat to become a nuclear power might provide greater diplomatic and strategic leverage than a "declaratory" nuclear posture.

Another conclusion might be that, since the number of nuclear weapons in the inventories of local countries and terrorist groups is likely to be small and their level of sophistication low, the use of nuclear weapons in a conflict might have relatively limited military and economic effects. Although the use of nuclear weapons in the Middle East would not have the same overtones of Armageddon that accompany scenarios of a US-Soviet exchange, the psychological impact would be very great and might frighten the international community into positive action to prevent the recurrence of such events. It therefore does not follow that a nuclear Middle East would automatically incrase the risks of proliferation elsewhere.

Finally, the Middle East is one of the areas of the world most likely to experience continuing violent conflict in the decades ahead. If, despite a greater availability of nuclear devices, the Middle East countries desist from adopting explicit nuclear policies, some measure of optimism can be suggested for the future of international strategic relations.

I. INTRODUCTION

The purpose of this paper is to speculate about the impact of nuclear weapons upon political-military relations in the Middle East in the 1980s. The actors in the "Middle East" in this context will be taken to include Libya, Egypt, Sudan, Israel, Lebanon, Syria, Jordan, Iraq and Saudi Arabia, as well as political groups such as the PLO. Three topics will be discussed: nuclear weapons and the Arab-Israeli conflict; nuclear weapons and inter-Arab political-military relations; and nuclear weapons and Middle East terrorism. The method of analysis will be, first, to discuss in general terms the types of nuclear weapons which might appear in the Middle East and, second, to analyze the target systems that might be considered most appropriate for nuclear threats and strikes and the force levels necessary for implementing nuclear strategies in the Middle East.

Against this background of speculation about the 1980s, two caveats are pertinent. First, the Middle East is perhaps the most volatile and unpredictable region in the world. If this paper had been drafted two years ago, speculation about a breakthrough in Egyptian-Israeli relations equivalent to the Sadat visit to Jerusalem and the Camp David accords would have been greeted with skepticism. By the time this paper is published, there may either be an Egyptian-Israeli Peace Treaty or the area may be on the brink of another war. The second caveat is that most observers believe Israel already has a nuclear capability of sorts; hence speculation about the "introduction" of nuclear weapons into the region in the 1980s may be somewhat passe. The way around this problem will be to assume that although Israel may have a nuclear capability, this has (a) never been officially admitted and (b) nuclear weapons do not play a role in the formulation of current Israeli military strategy, though they may well provide a backdrop against which judgments of the strengths and limitations of Israeli strategy may have to be made. In this paper it will be assumed that the introduction of nuclear weapons into the region means the formal, public announcement that henceforth nuclear weapons will be part of the political-military strategy of the region. While admitting that this distinction is arbitrary, it can be justified on the grounds that unless one is explicit about the presence of nuclear weapons, it is difficult to proceed beyond very general speculation about their purpose and capabilities.

Before discussing the political impact of nuclear weapons upon the Middle East, consideration of two issues involving the political-military environment in which the introduction of nuclear weapons may take place is in order: (a) a list of potential nuclear actors in the Middle East; (b) an examination of the Middle East as a target system. Without an examination of the likely nuclear actors and the types of targets nuclear weapons might be used or threatened against, the analysis will be of too general a nature to have any utility.

II. THE POLITICAL-MILITARY ENVIRONMENT

Although the purpose of this paper is to speculate about nuclear proliferation in the Middle East in the next decade, account must be taken of the contemporary non-nuclear military balance in the region and the parameters of military conflict that are already present in calculations about future hostilities. It can be argued that the "nuclearization" of the region, while having significant new qualitative implications, would be only a logical progression given the dramatic improvements in conventional capabilities that have taken place since 1967.

The military buildup in the Middle East since 1967 has been substantial. Both the standing forces of the major adversary forces and the reserve forces are much larger. The growth of weapons systems, has been equally, if not more, spectacular in both quantitative and qualitative terms. Although Egypt has been less successful than Israel and the other Arab confrontation states in building up its inventory since the 1973 war, it nevertheless has much superior armed forces to those it deployed in 1967.

Consequently, if a new Arab-Israeli war were to occur in the next year or so, it could be more destructive and extend over a wider area than any previous Middle East conflict. For example, given the range-payload and precision munitions of the Israeli air force, vulnerable, high-value infrastructure targets such as oil installations in Libya, Egypt, Iraq, and even Saudi Arabia could be attacked.

Some idea of the potential destruction of a fifth Arab-Israeli war can be gleaned from Table 1, which lists the changes that have occurred in the inventories of the Arab "confrontation" states and Israel since 1973. In four years all the adversaries, aside from Egypt, have gained greatly in conventional strength. The overall ratios show how Israel has improved vis-a-vis the Arabs, especially in armored personnel carriers and artillery. This refects a significant change in Israeli doctrine in favor of the combined arms approach to land warfare rather than the single-minded reliance upon the main battletank that dominated Israeli thinking between 1967-1973. Table 1 also gives some indication of the type of war that might be fought if the peace initiatives fail and conflict again breaks out. In a land campaign, tank battles equalling, if not exceeding, those between Germany and Russia on the Eastern Front in World War II might be possible.

The economic costs of such a buildup have been staggering. The arsenals of the confrontation states now approach those of the larger European powers. During 1977, Israel allocated 35 percent of its GNP to defense ($4.3 billion) and Egypt allocated 37 percent ($4.4 billion). Syria and Iraq allocated, respectively, $1.1 billion and $1.7 billion. Without U.S. aid to Israel, Saudi aid to Egypt, and Soviet aid to Syria and Iraq,

Table 1

Changes in Weapons Inventories, 1973-1977: Israel, Egypt, Syria, Iraq [1]

	1973	1977
Main Battle-Tanks		
Israel	2,000	3,000
Egypt	1,960	1,850
Syria	1,600	2,500
Iraq	860	1,350
Armoured Personnel Carriers		
Israel	1,000	4,000
Egypt	2,000	2,500
Syria	1,000	1,600
Iraq	300	1,800
Artillery		
Israel	400 (250 Self Propelled) (SP)	950 (500 SP)
Egypt	1,960 (No SP) [2]	1,300 (No SP)
Syria	575 '	800 '
Iraq	300 '	700 '
High-performance, Operational Combat Aircraft [3]		
Israel	340	620
Egypt	568	543
Syria	290	395
Iraq	218	335
Ratios	Arabs : Israel	Arabs : Israel
Main battle-tanks	2.21 : 1.00	1.90 : 1.00
Armoured personnel carriers	3.30 : 1.00	1.47 : 1.00
Artillery	6.41 : 1.00	2.90 : 1.00
Fighter-bombers [4]	3.16 : 1.00	2.03 : 1.00

[1] Geoffrey Kemp and Michael Vlahos "The Arab-Israel Military Balance 1977," in *Middle East Contemporary Survey*, Vol. 1, Holmes & Meier, N.Y. and London 1978. Jordan, if added, would not appreciably alter the balance in favor of a four-nation Arab coalition. Only in major air defense systems would it be capable, within the next 18 months, of strongly reinforcing Arab superiority in this sphere.

[2] SU-100/122 Assault guns are not considered able to fulfill the role of true self-propelled artillery.

[3] The complete Israeli inventory is included, as Israeli *Mystere* and *Super Mystere* must be considered the operational equals of the *Hunter* and MIG-17, the latter still deployed in large numbers by Arab air forces.

[4] Egypt, Syria, and Iraq have an enormous proponderance over Israel in terms of anti-aircraft defenses. In terms of larger SAMs alone (concentrated at corps and army level), total Arab stocks of SA-2/3/6 number c. 2,000. Jordan is currently in the process of receiving some 532 HAWKs from the US. Israel, in contrast, possesses only some 90 HAWKs for air defense, apart from short-range, divisionally allocated air defense systems such as *Chaparral* and *Redeye*.

these expenditures would be impossible.

It can be argued that these huge military budgets cannot continue indefinitely. In a situation of "no peace," economic factors alone might weigh heavily in decisions relating to alternative strategies, possibly involving nuclear weapons.

III. POTENTIAL NUCLEAR POWERS

In assessing the likelihood that the Middle Eastern countries and other regional political groups may become nuclear powers, it is first necessary to define what this highly ambiguous and evocative term means. In theory, any political unit that has control of a single nuclear device designed to explode can be termed a "nuclear power," but, from a military perspective, this definition is inadequate. Therefore, it is appropriate to distinguish between several hierarchies of nuclear powers that could exist in the 1980s.

Table 2 suggests that at least five types of nuclear powers may be in existence in the 1980s.[1] There is a vast difference between the capabilities of countries such as the US and USSR and the capabilities Middle East countries might have; there is also a significant difference between Hierarchy #2 countries (United Kingdom and France) and other powers. Despite their small size, the nuclear forces of Britain and France are very sophisticated, in part because they have been designed with the Soviet threat uppermost in their minds. Both Britain and France are theoretically capable of inflicting widespread damage on any country in the world aside from the US and USSR, against whom they can inflict "significant" damage. This is a formidable capability that does not come easily or cheaply. Both countries, but especially France, have invested billions of dollars in development of their respective nuclear programs. The global reach of their nuclear forces comes from the fact that both countries have deployed nuclear-powered submarines armed with ballistic missiles which can, in theory, reach most major targets in the world.

It is unlikely that in the next decade another power will join the ranks of Britain and France. The exception might be China whose current nuclear program, while substantial, has little global reach since it is based primarily on intermediate range ballistic missiles located in fixed or soft silos which are vulnerable to a first strike. Other countries which, under certain circumstances, could join Britain and France as Hierarchy #2 nuclear powers include West Germany and Japan. But both countries would need a great deal of help to develop a sophisticated program or would have to outlay very large sums of money to catch up with the other nuclear powers. If

[1] Many more than 5 Hierarchies or Sub-hierarchies can be imagined. However, the five listed cover a sufficiently wide spectrum for the purposes of this paper.

Table 2

Possible Nuclear Hierarchies in 1980s

Hierarchy	Nuclear Force Type of	Basic Requirements	Examples
# 1	Second strike, global nuclear force.	Capable of inflicting widespread devastation against all countries in world in second strike capacity.	US and USSR
#2	Second strike, limited global nuclear force.	Capable of inflicting significant damage against US and USSR and widespread damage against all other powers in second strike capacity.	Hierarchy #1, plus Britain, France.
#3	Second strike, regional nuclear force.	Capable of inflicting significant damage against all targets in region in second strike capacity.	Hierarchy #2. plus China, Israel, India.
#4	First strike, regional nuclear force.	Capable of inflicting significant damage against any power in region in first strike capacity.	Hierarchies #1 and #2 and #3, plus ROK, Taiwan, Egypt.
#5	Catalytic nuclear force.	Capable of detonating one or two bombs against virtually any country.	Hierarchies #1, #2, #3, and #4, plus any country or group with access to nuclear fuels or weapons.

Notes: "Significant damage" means the capacity to destroy or threaten an array of important countervalue and counterforce targets with a high probability of success. In the case of strikes against the US and USSR, this could mean the ability to destroy four or five major metropolitan areas or very important military facilities and production plants.

Germany and Japan unilaterally decided to go ahead with serious nuclear weapons programs today, it would probably be well into the 1980s before they had an operational system with Hierarchy #2 characteristics.

When we talk about a nuclear Middle East in the 1980s, we are almost certainly referring to countries that might fall into Hierarchies #3, #4, and #5. The most likely candidate to be a declared nuclear weapon state is Israel. As mentioned earlier, many believe Israel already has some nuclear weapon capabilities. In any event, Israel has strong political and military motives to ensure its continued technical superiority over the Arabs and, in the last resort, has to anticipate possible US abandonment and Soviet military hostility. In addition, Israel has the technological and industrial infrastructure to provide the delivery and support systems necessary for the operational deployment of nuclear forces in the Middle East.

On the other hand, it might be argued that since Israel currently has such powerful conventional forces and has won all the wars it has fought, its adversaries are

the ones that can make the best case for a nuclear option. There is some merit in this argument; but it ignores the overriding sense of strategic insecurity Israel feels in its conventional military relationship with the Arabs. Israelis contend that it is small consolation to know that they have won four wars because, unlike the Arabs who can lose decisively and still remain viable states, they have had to win. Given its geography and small population, Israel has only two alternatives: to deter war or to be the victors in war. With the economic power, territorial size and population of the Arab countries, it is only a matter of time before Arab mass begins to offset Israeli quality. Nuclear weapons would buy Israel time but, like other weapons, could never ensure its ultimate security.

As suggested earlier, a fifth non-nuclear Arab-Israeli war that involved all the Arab confrontation states would probably be extremely costly to all sides. While the current wisdom gives Israel a significant superiority over all combinations of Arab powers should conflict occur within the next five years or so, no one is prepared to argue that such a victory would be easy. Israeli casualties in the thousands could again be expected, and unless a fifth victory brought in its wake guarantees of peace, Israel would then have to contemplate the prospect of preparing for a sixth war. It is in this context that the odds against Israel might begin to mount. Quite apart from the psychological, physical, and economic costs of endless war preparations, it can be argued that by the mid-to-late 1980s the Arabs might have enough power to wage a protracted war of attrition against Israel and eventually bleed Israel to defeat. By this time, so the argument goes, Egypt could be re-equipped with Western weapons, Saudi Arabia could be on the way to becoming a serious military power, Lebanon could be a major confrontation area, and the Soviet Union's capacity to intervene with military force might be much greater than today. In these circumstances, and in the absence of any peace settlement, the inevitable pressures on Israel to formally exercise a nuclear option would be compelling.

Israel is also placed at the top of the list of possible Middle East proliferators because none of the Arab countries, including the oil-rich countries, are likely to have the indigenous capacity over the next decade or so to undertake a serious nuclear weapons program. Although several Arab countries will soon have operational nuclear power stations which may give them access to certain nuclear fuels, they do not have the infrastructure or skills to undertake the engineering tasks necessary for the fabrication of an operational inventory of weapon systems. (This is not to say that some Arab countries will be unable to obtain fuels for one or two crude nuclear devices which could be used for blackmail.) Israel, on the other hand, has the capability to become a Hierarchy No. 3 power: that is, to develop enough weapons that can be protected against any combination of Arab strikes and to ensure that it can inflict significant damage on Arab targets.

Several of the Arab countries could achieve Hierarchy No. 3 status if they were provided outside assistance. It is difficult to imagine the circumstances under which the Soviet Union or any other nuclear power would hand over relatively advanced nuclear weapons and the associated delivery systems to any of the Arab powers. The Soviet Union has been more reluctant than the United States to share its nuclear weapons with allies or friends. Without overt cooperation from a major nuclear power, the most the Arab countries could expect from external sources would be the possibility of covertly "buying" one or two nuclear devices from a maverick nuclear power. There have been persistent rumors that in the early 1970s Colonel Qaddafi of Libya tried to purchase a nuclear weapon from China. The fact that he was unsuccessful at the time does not mean that this option is forever ruled out.

Lastly, there is the possibility that a nuclear weapon could be stolen from the inventories of the existing nuclear powers. If enough money were offered for the theft of a weapon, criminal organizations might be prepared to bid on the contract and might indeed succeed in the enterprise. The probabilities of this happening would depend on the security under which the weapons were held. Given the scares in recent years about nuclear theft it can be expected that stealing a nuclear weapon would be no easy task even for an extremely well-endowed band of criminals.

IV. THE MIDDLE EAST AS A TARGET SYSTEM

The primary utility of nuclear weapons is that for a given payload each weapon generates an enormous amount of destructive energy in the form of blast, heat, and nuclear radiation. To be effective in military, political, and economic terms, the weapons must be detonated over, under, or close to a specific target or group of targets. The essence of nuclear strategy is the ability to threaten or protect a given list of targets. Consequently, before discussing the use of nuclear weapons—even single, low-yield weapons—in the Middle East, it is necessary to review the primary targets that could be attacked in a nuclear confrontation.

This may seem such an obvious point that it requires little elaboration. However, an analysis of potential target systems in the Middle East reveals that their configuration (a) is changing dramatically; (b) is not evenly distributed; and (c) requires different types of nuclear weapons to be threatened with serious damage levels. The target systems can be broken down into three basic categories: military targets, including "hardened" targets such as command and control positions; "semihard" targets, such as protected airfields; and "soft" targets. The last include troop concentrations, communications, supply depots, repair facilities, road and rail lines, econonic targets (including factories, fuel and energy sources, water production and distribution systems, ports, roads, dams, etc.), and urban targets.

One can make further distinctions in the military list between what might be termed "tactical" targets, such as troop formations and "strategic" targets, such as primary airfields, ports, and depots which are at fixed locations, usually in rear areas.

Applying this classification and the subsequent lists of targets to the Middle East area, the following observations can be made:

A. Israel.

The vulnerability of Israel to nuclear attack is very great. Its military targets are located in known, concentrated areas, including the Sinai desert. If Israel returns the Sinai to Egypt, it will have to rely even more upon a few key military bases which will be closely grouped. There will be no room to "hide" military forces in Israel; support facilities, including the three key ports at Haifa, Ashkelon, and Eilat, are very vulnerable. In terms of infrastructure and population, Israel is equally vulnerable. Population and industry are co-located in the major urban areas of Tel Aviv, Haifa, and Jerusalem. In addition, the intricate water distribution system so vital to agricultural development is a key strategic target. (This system transports water from the north of the country to the Negev in the south via a series of underground aquaducts and pipelines.)

In sum, Israel has many of the characteristics of a typical small industrial state. However, with the exception of the 1948-1949 War of Independence, there has been very little damage to Israeli internal targets in the wars fought with the Arabs. Although there have been persistent fears in Israel of Arab attacks on the population centers, these have never materialized, in part due to Israel's emphasis on fighting wars on or over enemy territory or captured territory rather than over or on Israel proper. The introduction of nuclear weapons into the Middle East would radically alter this state of affairs, and for the first time since 1949 Israel would have to assume that its "rear" areas would become part of a future battlefield. This prospect alone is sufficient to strengthen the argument for an "ultimate" Israeli deterrent.

B. The Arab Countries

Israeli vulnerabilities are familar to most students of Middle East affairs, but there is less awareness of the relative vulnerabilities of the Arab countries. It is therefore appropriate to outline some of the changes that are taking place in those Arab countries that might become targets in the event of the spread of nuclear weapons to the area. Rather than provide a comprehensive listing of all target systems in all Arab countries, a detailed examination of one country—Saudi Arabia—will be made, together with less detailed examination of Libya and Egypt.

Since 1973, the combination of peace and abundant wealth has begun to transform the nature of the oil rich countries; some of this transformation has spread to the less rich Arab countries, such as Egypt, Syria, and Jordan. Eleven years ago, at the time of the June 1967 war, the strategic infrastructure of the Arab world was primitive; aside from obvious targets, such as the Aswan dam, the Suez Canal, and the Saudi Arabian oil fields, most of the countries in the region were underdeveloped. Ten years from now, in the late 1980s, many of these countries will resemble—at least in terms of targets—modern states.

1. Saudi Arabia

In addition to the existing oil fields—especially the Gawah Field and the terminal facilities at Ras Tanura—Saudi Arabia has five major refineries, Ras Tanura (415,000 b/d), Jiddah (12,000 b/d), Riyadh (15,000 b/d), and two it shares with Kuwait. Planned or under construction are at least two very large refineries at Jubail al-Bahri (350,000 b/d), and Yawba (250,000 b/d). The latter is located on the Red Sea near Jiddah. There are schemes to build new crude oil pipelines to outlets on the Red Sea which would avoid the need to use the Straits of Hormuz for oil transportation. These projects include (a) a 400-mile spur (capacity 500,000 b/d) from the present Trans-Arabian Pipeline (TAP), which runs from the Abqaiq oil fields 850 miles across northern Arabia, through Jordan and Syria and into Lebanon, to the northern end of the Red Sea; (b) an entirely new pipeline with an initial capacity of almost 2,000,000 b/d running from the main Saudi fields to the area of Jiddah. The new pipeline and terminal on the Red Sea will become a major area for new industrial complexes.

In addition to the investments in petrochemical and petrochemical-related facilities, the new wealth of Saudi Arabia is reflected in the construction schemes throughout the country for ports, roads, airports, water and desalinization plants, railroads, industry, and military facilities. Among the more extensive projects are plans for a major expansion of the ports at Jiddah, Demman, Yenbo, Jubail, and Jizan. More than 1,650 kilometers of new roads are now under construction; work is proceeding on 15 new airports throughout the country. Contracts have been let for satellite tracking and radar facilities on these airports. Two water desalinization plants are under construction at Jiddah, and bids for at least four others are in the offing. Enormous housing developments are under way around the major cities, and billions of dollars worth of military construction work, designed and managed by the US Army Corps of Engineers, has begun. A contract for 480,000 telephone links is being negotiated with a European consortium. Iron deposits are being explored at Wadi-Sawain in the north of Saudi Arabia. Phosphate exploration is taking place with Swedish help around Turaid, and copper deposits are being explored at Kian and Telha by the Canadians and at Gebel Said by the French.

This adds up to a radically transformed Saudi Arabia by the mid-to-late 1980s. The array of potential targets in any war with other Arab states, Iran, or Israel is extensive. As will be discussed later, many of the new infrastructure facilities are highly vulnerable to the type of damage nuclear weapons, even small ones, could cause.

2. Libya

Saudi Arabia is the most spectacular example of modernization in the Arab world, but Libya also has very extensive development plans for a transformation of the desert. The road system has been radically improved, and a new highway from Sabha to the Chad border has recently been completed. Major urbanization and agricultural development and resettlement schemes are under way throughout the country. A new oil field at El Mehuriga opened in 1975 with a 12,000 b/d capacity. There are plans to expand the cement plants at Khoms and Benghazi. New oil refineries were opened at Zawia in 1975 with a starting capacity of 6,000 b/d.

Among the many military construction programs under way are antitank fortifications built by the Bulgarians along Libya's border with Egypt, and military outposts in Chad (from Aozou 100 miles into Chad and all along the 600-km border between the three countries). This area is rich with magnesium and uranium. Recent Libyan government maps include sections of what is now Chad.

In sum, Libya, like Saudi Arabia, is becoming a modern state which, in military terms, means that it bears little resemblance to the Libya of the past. In the event of a major conflict in the Middle East, Libya would be very vulnerable to the conventional and nuclear attacks that modern weapons make possible.

3. Egypt

Egypt, although not having the oil wealth of Saudi Arabia and Libya, has received substantial loans from the OPEC countries, especially Saudi Arabia. If a peace settlement with Israel is negotiated, Egypt will undoubtedly be able to increase its borrowing capacity in the United States and in the international financial community. Despite inherent poverty, Egypt has grandiose plans for the expansion of its economy and several important infrastructure projects have been developed since 1973. Perhaps most important is the Sumed pipeline which connects the Gulf of Suez with the Mediterranean and enables tankers not capable of transiting the Suez Canal to unload their oil at the Port of Suez and have it pumped to the Mediterranean terminals. Other major projects in Egypt include the development of the oil in the Gulf of Suez and the Sinai, the expansion of port facilities at Alexandria, and the offshore terminals for the Sumed.

V. TARGETS AND WEAPONS EFFECTS

The vulnerability to attacks by nuclear and non-nuclear munitions of the types of targets mentioned above varies considerably. Even in the case of a vulnerable target system such as oil infrastructure, there are major differences within the subset of targets because different components of the oil supply system have different vulnerabilities. Although oil wells are easy to hit with air-delivered munitions or sabotage and oil pipelines are easy to destroy, they are also relatively easy to repair. The most vulnerable targets in the oil system are the pump facilities in the loading terminals. If these are destroyed, it would take many months to bring output back to the pre-attack level. For example, if the Saudi Arabian facility of Ras Tanura were hit by a nuclear weapon, a very large percentage of Saudi Arabian oil exports would be cut off even if little or no damage were done to the oil fields themselves. The importance of Ras Tanura will decrease as the alternative pipelines to the Red Sea open up, but that is a long way off. In short, oil facilities are particularly susceptible to nuclear explosives. To do long-term damage with conventional munitions would require fairly accurate deliveries which, with the possible exception of Israel, the local countries do not have. However, a single crude nuclear device on the loading terminals and the refineries would create havoc and chaos.

Infrastructure targets, such as ports, factories, and desalinization plants, are less vulnerable than oil facilities but nevertheless would be very easy to destroy with a relatively inaccurate low-yield nuclear weapon. The magnitude of damage that could occur in the event of limited nuclear warfare is suggested by the fact that the Israeli air force, in 180 sorties using conventional unguided munitions, destroyed more than one-fifth of the Syrian energy infrastructure and transportation system and kept it out of action for many months. Had Israel used precision munitions or nuclear weapons, the damage would have been far greater. The only compensating factor is that the proliferation of targets themselves suggest that large numbers of nuclear weapons might be needed if a complete systematic attack on the Saudi, Libyan, or Egyptian economy were to be contemplated. A single nuclear device, if used for maximum effect would probably be aimed at either oil terminals or population centers or, in the case of Egypt, some unique target such as the Aswan Dam.

The Arab countries have larger populations than Israel but, like Israel, there are high population densities in urban industrial areas and most highly skilled and trained personnel would be immediately threatened in the event of a nuclear war.

The yield of weapons necessary to inflict significant damage on the infrastructure and urban areas would vary depending upon the configuration of the target. In cities like Tel Aviv and Cairo, weapons of the yield of the Hiroshima bomb (14 kilotons)

would totally destroy major downtown areas. Similarly, weapons of that yield would be adequate for destroying the infrastructure. The number of weapons available would be more important than the yield.

VI. DELIVERY SYSTEMS

Air-delivered weapons systems would probably be the most likely for the Middle East countries. Advanced ballistic missile delivery systems require especially exacting engineering technology for warhead production. This raises questions about the probability that an air-delivered nuclear weapon could reach targets throughout the Middle East in the face of intensive air-defense capabilities. Given the fact that the antiaircraft abilities of most countries are very considerable, especially for point defense and, in the case of Israel, the entire defense of the pre-1967 borders, the numbers of weapons rather than yield or accuracy may be the constraining factors.

The analysis suggests that numbers are an important factor in determining the ultimate destructive capability of nuclear forces in the Middle East. Assuming that all the countries, including Israel, are likely to be limited in the numbers of weapons they can produce, then some questions about target optimization must be discussed. With this in mind, the three scenarios outlined in the beginning of the paper will now be considered: namely, the Arab-Israeli conflict; inter-Arab conflict involving nuclear weapons; and nuclear terrorism by subnational groups.

VII. NUCLEAR WEAPONS IN THE ARAB-ISRAELI CONFLICT

Two sets of circumstances can be hypothesized in this case: first, the more likely scenario in which Israel alone possesses a nuclear capability; secondly, a situation where both Israel and one or more of its Arab antagonists possess nuclear weapons. The first case assumes that Israel has found it necessary to adopt a declaratory nuclear policy vis-a-vis the Arab countries. Presumably this policy would be couched in terms of "deterrence." While one can well imagine the circumstances under which Israel might announce such a doctrine, it is difficult in practice to think through what such a policy would say. One assumption would be that an Arab conventional attack, having succeeded in breaking the initial Israeli defense with conventional forces, would then threaten Israel's heartland and at this point an Israeli decision to use, or threaten to use, nuclear weapons would be contemplated. The decision then would be whether to consider nuclear weapons for tactical purposes; i.e., to stop the advancing Arab armies or, for strategic purposes, namely to threaten the Arab homelands. The answer to this would depend a great deal on the evolving nature of the military battle and the degree of flexibility and invulnerability Israel had in its nuclear force. An invulnerable second strike force (for instance, hardened missiles with nuclear warheads in large numbers)

would permit Israel many options in contemplating nuclear war. On the other hand, one or two weapons earmarked for delivery by aircraft would pose a more difficult decision. How to use the marginal weapon would be a problem: threatening or dropping one or two bombs on Cairo and Damascus might cause chaos within those respective countries, but it would not defeat the Arab armies. Unless Israel could follow up such a strike with the threats of further attacks, the end results for Israel would probably be defeat rather than a ceasefire. Again, one comes back to the fundamental questions of the type of nuclear force, the numbers of weapons in the inventory, and the nature of the strategy Israel wished to pursue.

The risk of relying on a small nuclear force capable only of destroying a few Arab cities is that the bluff might be called. Furthermore, the scenario implies a successful breakthrough by the Arab armies. This would almost certainly have to be accompanied by some measure of Arab air superiority, in which case Israel's nuclear force might well be subject to Arab air attacks before it could be launched. Hence, the vulnerability of the system would be a critical factor in determining when and where it was used. If the system were relatively vulnerable, then an early decision to invoke the declaratory policy would be essential. But to make the system invulnerable to Arab attacks would require major capital investment and a very elaborate command and control system which, given the disadvantage of the small size of Israel, would tax Israeli ingenuity. In short, the nuclear option for Israel does not, in practice, look easy. If it were to be chosen, then better it were done properly; for this, a large number of warheads would probably be required. It is conceivable that a terror weapon of the last resort would, in fact, deter the Arabs from contemplating war in the first place but, given the fact that a conventional imbalance will eventually occur, it cannot be ruled out that the Arabs would attack knowing full well that the Israelis would have to be the first to use nuclear weapons.

The second case—nuclear weapons in both Arab and Israeli hands—poses much more complicated questions, though of a similar type: namely, how many weapons and in whose hands and with what capabilities? Israel is more vulnerable to attack from a small nuclear force than Arab countries because one bomb on Tel Aviv or Jerusalem would be unmitigated disaster for the entire country, whereas the Arab world could survive the loss of one capital city. The capabilities of the Arabs and Israelis in the nuclear field are likely to be asymmetric; consequently, if both sides develop nuclear weapons there would almost certainly be asymmetries in the force structure. An Arab declaratory policy in these circumstances might have more effect than an Israeli declaratory policy given the Israeli vulnerabilities discussed above. However, a small vulnerable Arab force, the location of which was known to Israeli intelligence, would become a very tempting target for pre-emptive conventional attacks. To "hide" an Arab nuclear force beyond the reach of Israeli aircraft would

require a sophisticated delivery system and would run the risk of not guaranteeing penetration of Israeli air space. The Arabs would have to assume that, in any war, the Israelis would attack Arab nuclear facilities at the initiation of hostilities. In fact, an Arab declaration of a decision to go for nuclear weapons might in itself be a *casus belli.*

In sum, it can be argued that the introduction of nuclear weapons to the inventories of either Israel or Egypt would probably not bring with it the "stability" presumed by some to come from the balance of terror. In theory, a model mutual nuclear deterrence system might work in the Middle East, but that is not likely to come about, and the very uncertainties involved might result in a much more unstable, uncertain equation of power. Therefore, it would appear that both Israel and the Arab countries would run great risks if nuclear weapons were formally introduced into the conflict scenario. Given the potential asymmetries in terms of Arab conventional power, however, it seems likely that this will, in fact, be an inevitable occurrence unless formal peace agreements can be reached.

VIII. INTER-ARAB CONFLICTS AND NUCLEAR OPTIONS

The current wisdom is that an effective peace treaty between Egypt and Israel would rule out a serious war option for the remaining Arab states if they continued their confrontation with Israel. While such a treaty would not result immediately in a relaxation of military vigilance by either Egypt or Israel, over time both parties would feel less threatened by each other and therefore the need to deploy large numbers of forces earmarked for the Sinai contingency might diminish. This process might be accelerated in the event of joint Egyptian-Israeli ventures for economic development of the Sinai.

The *de facto* decoupling of the Arab-Israeli equation would have the further effect of "releasing" Egyptian forces for other contingencies in Africa and the Arab world. Whether or not the Egyptian leadership will choose to play a more assertive military role in its relationship to other Arab states is difficult to tell. However, from the perspective of its Arab neighbors, especially Libya and Sudan, the prospects for armed confrontation with Egypt would assume new, more serious, proportions. Egypt's armed forces, as compared with other Arab or nearby African nations, are far and away the best organized, best equipped, and most experienced.

The extent to which a nuclear option for the Arab countries would increase in the event of an Egyption-Israeli settlement is therefore an important question. The removal of Egypt from the central military equation not only raises questions about Egypt's future military relationships with the Arabs but compounds the problem for

the remaining confrontation states such as Syria and Jordan, since they would now be faced with an even stronger Israel in relative terms. Thus one might make the argument that an Egypt-Israel settlement could encourage any propensities for nuclear option among the remaining Arab states. This could apply particularly to Libya which (a) has reason to fear Egypt, (b) is ruled by a quixotic leader, and (c) has the money to invest in exotic weapons systems. Whether Libya or a combination of radical Arab states could procure nuclear weapons from outside is a debatable point. But on the assumption they could or were in the process of obtaining nuclear weapons, then clearly this would have a major effect upon both Israel and Egypt and could either lead to joint Egyptian-Israeli cooperation to guard against nuclear threats from the radical Arab states or to both Egypt and Israel pursuing independently their nuclear options.

On the assumption that several countries within the Arab world had access to nuclear weapons, questions similar to those of the Arab-Israeli situations arise with respect to using the weapons in formulating strategy. Short of a full-fledged operational nuclear force, which is highly unlikely, nuclear weapons could probably do little more than raise the stakes in the event that an inter-Arab dispute led to military confrontation. Thus, ongoing conflicts such as those between Syria and Iraq for water supplies, and Libya and Egypt over boundaries, would take on new dimensions if nuclear weapons were part of the backdrop. Given the volatility of Arab politics and of some of the decisions taken during the heat of battle in previous Arab-Israeli wars, it is certainly not impossible that one or more weapons might actually be used in the event of inter-Arab wars. The impact of such nuclear weapons on the nature of the conflict would depend on the target systems and the yield and number of weapons used. Here again, similar calculations to those done earlier apply.

IX. NUCLEAR TERRORISM

The prospect that the PLO or other radical groups in the Middle East could obtain a nuclear device is not far-fetched. The PLO is the most likely group, given its incentives, its organization, its international contacts, and most important, its budget. How such weapons would be used and what their effects would be is another matter. Certainly the PLO would be tempted to threaten to use or even use the weapon, especially if separate peace between Israel and Egypt emerges and traditional Arab animosity to the Palestinians continues. Whether the PLO would choose to target Israel, an Arab country, or some Western country is debatable. It is not difficult to imagine a situation where Palestinian demands were backed up by nuclear blackmail. In these circumstances, there is no doubt that the initial response would be in favor of compromise; i.e., giving more ground to the Palestinians. However, in the aftermath of such blackmail attempts, it seems likely that the revulsion of most states might lead to

intensive crackdowns on nuclear theft and the relationship between the PLO and other radical groups. Thus, from the PLO's perspectives, a nuclear device used for such purposes might be a once-and-for-all effort. Such use of a nuclear device would surely strengthen the determination of Israel and many of its neighbors not to give in to radical pressures even though immediate compromise might be necessary.

It could, therefore, be argued that, while nuclear blackmail might appeal to the PLO leadership, the actual use of the weapons carries great risks, risks that the more moderate element in the PLO leadership might not want to take. This is not to say, however, that the more extremist factions might not be prepared to detonate nuclear weapons against Israel or conservative Arab countries irrespective of the ultimate costs to the Palestinian cause.

X. A NUCLEAR MIDDLE EAST AND US-SOVIET RELATIONS

Nuclear weapons in the Middle East will certainly make local rivalries more intense and more unstable and would be likely to raise questions in the minds of the external powers as to what role they should play. On balance, neither the United States nor the Soviet Union stands to benefit from a proliferation of nuclear weapons to the Middle East area. However, if proliferation does occur, both superpowers will have to adjust to this factor. The Soviet Union has more to fear directly than the United States, although if the effect of nuclear proliferation is to heighten the risks to Israel, then the United States will be drawn in willy-nilly, as the ultimate guarantor of Israel's survival.

Soviet reasons for concern would have to do with the possibility that a country such as Israel might be able to threaten, under certain circumstances, key Soviet targets. Valuable Soviet targets in the Ukraine, including Kiev, and the very important industrial area in the Donets-Dnep complex and Lower Trans Volga are close enough to be threatened from Israel. Certainly the Soviet Union cannot rest assured that Israel, over the next 10 to 15 years, could not procure cruise missile technology and the warheads necessary to threaten such major Soviet targets. The United States faces no such threat but, if it were called to provide a guarantee to Israel or Egypt or any other combination of Arab powers vis-a-vis radical Arab nuclear threats, the question of the US response would raise some very difficult crisis management problems. On balance, it seems likely that both the superpowers would have a common interest in defusing the escalatory impact of nuclear proliferation in the area. Both would seem to have a mutual interest in arms control measures to minimize the possibility that nuclear weapons systems might be developed in the Middle East. Thus, the prospect for proliferation might encourage limited US-Soviet arms transfer agreements to restrict the sale of items such as sophisticated surface-to-surface missiles to this or any other region.

THE CONSEQUENCES OF NUCLEAR TERRORISM

Brian Michael Jenkins
The Rand Corporation

ABSTRACT

The political consequences of any act of nuclear terrorism would depend on the political circumstances in which the act occurred plus other variables (whether a device were actually detonated, whether the detonation was preceded by a warning plus demands, the size and location of the blast, the degree of government collusion, etc.). The possible combinations suggest innumerable scenarios. Therefore, we have concentrated on identifying the probable broader consequences that would derive from the fact that a subnational group—a terrorist group, beyond the direct control of any government, although perhaps with some government assistance—has detonated a nuclear device. These include:

- greatly increased security at all nuclear facilities;

- a crackdown on all terrorists and, in some countries, on all political dissidents, with public approval;

- a greatly intensified debate over nuclear disarmament and nuclear energy with the proponents of disarmament and foes of nuclear energy provoked to take more extreme measures, including acts of major violence in the name of saving society;

- increased pressure for a new international regime to ensure the physical security of nuclear facilities and nuclear material to include measures ranging from the establishment of stringent minimum international security standards, which is probably acceptable, to internationalization of facilities where nuclear material of weapons grade may be available or the guarding of such facilities by an international force, measures that would radically depart from the current rigid adherence to the principle of national sovereignty in matters of security and would be resisted;

- increased pressure by suppliers of nuclear technology on countries that resist such measures including suspension of cooperation in their nuclear programs, suspension of fuel shipments, suspension of reprocessing services, and economic sanctions;

• resistance to such measures by some who perceive them as intended to establish a permanent nuclear hegemony for economic and political reasons followed by a shift to development paths leading to nuclear independence;

• acceptance of international security measures by others who fear they may in the future be the victims of nuclear blackmail and internationalized security is their best protection;

• warnings of unilateral preemptive military action and military retaliation against states that collude with terrorists seeking to acquire nuclear capabilities;

• the possibility of further acts of nuclear terrorism inspired by the first and the likelihood of alarming nuclear hoaxes;

• mixed reactions with regard to future national decisions to develop nuclear weapons;

• the sharing of nuclear weapons security technology and increased international cooperation in the area of intelligence, response to nuclear crises, and recoverry limited somewhat by fears that some participants in any new collective intelligence effort might act unilaterally and prematurely within a context of factual uncertainty;

• and renewed attention to strategic topics of signature, paramilitary nuclear attack, clandestine delivery, and civil defense.

I. INTRODUCTION

In the last decade the possibility of nuclear terrorism has become an increasing concern which has preoccupied government officials, scientists, political analysts, the news media, and the public, and has inspired novelists. The fear is understandable in the current era of terrorism. Terrorist bombings, assassinations, kidnappings, and hijackings have become part of our daily news diet. Terrorists seize hostages in trains, airplanes, or government buildings. Why might not terrorists some day hold an entire city hostage with a stolen nuclear weapon or a clandestinely fabricated explosive or dispersal device?

The word "nuclear" in any context is inherently frightening. It is to many people a sinister force, recalling Hiroshima and Nagasaki, conjuring a vision of mass destruction. The idea of terrorists with nuclear weapons is especially frightening. Terrorists are often viewed as irrational and suicidal; their violence is seen as indiscriminate and random.

"There is no doubt that when the bomb goes off, and it will, the destruction will have been caused by a handful of terrorists and not a world power."* Many people believe that terrorists will be the first to use a nuclear weapon. Terrorists are considered to be less morally and politically constrained than national governments. They have no territory, no cities, no populations to protect. They would be willing, it is thought, to threaten or commit mass murder. The willingness of terrorists to commit mass murder is exaggerated. There are counterarguments that terrorists may be subject to political and organizational constraints that limit the escalation of violence, even by those we call terrorists.

However, it is not the primary purpose of this paper to argue the probability of nuclear terrorism which, in the final analysis remains a matter of speculation, but instead to presume that a serious incident of nuclear terrorism has occurred, and then to examine the consequences. Will it significantly alter the political landscape of the world? Will it change attitudes about nuclear arms or nuclear energy? Will it lead to a new international regime of cooperation and control? Will it increase the likelihood of further use of nuclear weapons by states or terrorists?

* The statement was made by Tony Foster in an interview published in the *Valley News*, California, August 17, 1978. In the interview, Foster is described as an "international entrepreneur and mercenary pilot." He is the author of *Zigzag to Armageddon*, a novel about nuclear terrorism, one of a fast-growing genre.

II. BASIC ASSUMPTIONS

A. Assumptions about the Political and Social Context in the 1990s

In accordance with the assumptions provided as a basis for this colloquium, we are supposing that by 1990 more than a dozen countries will have acquired a nuclear weapons capability and that many others will be able to do so in a brief period if they want to. The new nuclear weapons states may include some of those regarded as dangerous, because of their political instability, unstable or reckless leaders, involvement in continuing international crises, revanchist aims, or record of military adventures. Despite this degree of nuclear proliferation, we are assuming that no nuclear war has occurred.

We further are to assume that the world's energy situation has become more critical, with fossil fuels more expensive and scarce, that an expanding world population has increased pressure on the world's food supply, that the gap between the rich and poor nations has widened, and that terrorism has probably intensified and spread.

The author wishes to add one other assumption: centrifugal tendencies that began with decolonization in the 1950s, and continued in the various ethnic minority and regional autonomist movements have persisted. These forces have led to the creation of new independent states in Africa, the Caribbean, and the Pacific, the majority of them the remaining chips and splinters of defunct empires. By 1990, we assume a world of 200 independent nations. Sovereignty is a powerful concept. In other areas, these centrifugal forces have led to somewhat looser central government authority through various schemes of devolution. In a few cases, they conceivably could have led to the disintegration or to the *de facto* partition of some states: Lebanon, Cyprus, Yugoslavia, etc. This centrifugal pull has affected political stability in a number of countries and complicated relationships in a number of regions, notably the Balkans, Central Asia, Southeast Asia, and possibly North America and the Caribbean.

We may also assume the existence of several regional trouble spots. Conflicts between radical and conservative Arab governments or governments dominated by different factions, internal instability caused by the stress of rapid modernization and the presence of large "foreign" minorities in the conservative oil-rich countries, and continued competition between the superpowers are likely to have kept the Middle East an area of tension despite progress in Arab-Israel negotiations. Iran may still be suffering from constant or intermittent political violence coming from both the political left and the religious right.

Presumably, the issue of succession in Yugoslavia will have been settled by 1990, but the passing of Tito could initiate a period of instability in Yugoslavia that, combined with internal problems in Turkey and possible growing nationalist tendencies in the Soviet Union, could make the Balkans another area of international tension.

Most observers agree that the same centrifugal ethnic and national minority forces that have increased throughout the world will inevitably affect the Soviet Union as well. Although it is unlikely that the Soviet Union will fragment, by 1990 it may be experiencing internal tension on minorities issues. Tensions in Central Asia (Pakistan, Northwest India, Iran, Afghanistan) may increase as a result of continuing traditional regional conflict; for example, that between India and Pakistan, and ethnic struggles (Kurds and Baluchistanis).

Resolution of the situation in Rhodesia is likely before 1990. However, it is assumed that South Africa will experience serious guerrilla warfare beginning in the 1980s. In 1990, Indochina and the neighboring states of mainland Southeast Asia (Thailand and Burma) are still an area of local conflict with limited intervention by both China and the Soviet Union. By 1990, US military support for both South Korea and Taiwan, if it still exists, may be minimal; the political future of both nations could become major issues in the 1980s.

There are several possible problems in the Caribbean, Central America, and Mexico including political violence provoked by a possible change in the political status of Puerto Rico, internal political instability (perhaps with Cuban support) in a number of Central American countries, and growing political violence in Mexico. Finally, the Quebec separatist issue could persist through the next decade, causing some instability in Canada. In sum, there will be ample political struggles, some of which may be expressed through terrorist violence.

B. Assumptions about Terrorism

As mentioned previously, we presume terrorism will persist as a mode of political expression and of achieving limited political goals. There may be periods of diminished terrorist activity. The loci of terrorist violence may change, although Latin America, the Middle East, and Western Europe are likely to suffer a disproportionate share. The identity of the terrorist groups will change but the use of terrorist tactics will continue.

Ethnic minorities, separatists, refugee groups seeking autonomy or equality, along with others with various ideological motivations, will provide the basis for terrorist

activity. We may see terrorist activity on behalf of a number of Third World issues or worldwide concerns, such as the redistribution of the world's wealth, food shortages, etc. We may also see terrorism aimed at the technology of the modern industrial states which may be viewed by "neo-Luddite" terrorists as destroying the earth and dehumanizing man. Finally, it is possible that some of the existing terrorist groups will have evolved into quasi-political criminal gangs who will continue terrorist activity—kidnappings, assassinations, extortion—to maintain a cash flow, and who may carry out specific operations on commission.

Terrorists will continue to develop links with each other, forming alliances, providing each other with various forms of support, occasionally carrying out joint operations. Some groups will receive covert support from sympathetic governments who may in turn employ terrorist groups to carry out operations against other governments.

Terrorists will become more sophisticated in their tactics and weapons. They will acquire some of the new portable weapons now being deployed in modern armies such as hand-held, precision-guided, anti-tank and anti-aircraft missiles. They will exhibit greater willingness to take on armed guards at protected facilities. The apparent constraint on the scale of terrorist violence may erode somewhat. Several attempts to shoot down airliners with ground-to-air missiles, in one case succeeding in bringing down an airliner in Rhodesia in 1978, and several other large-scale actions suggest a new scale of violence. In the 1980s we may see occasional terrorist incidents involving several hundred dead.

III. WILL TERRORISTS GO NUCLEAR?

Several of the participants in this colloquium, in their papers and during the subsequent discussions, mention the possibility of nuclear arms in the hands of terrorists. Putting aside the issue of the comparative likelihood of further national versus subnational acquisition of nuclear weapons, the latter possibility is generally seen as giving greater cause for concern than proliferation in a dozen or more states in the next ten to fifteen years.

We seem here to have taken a rather benign view of proliferation. Possession of nuclear weapons by additional states has been viewed, at least at this meeting, as less disruptive to world order than it often has been portrayed, in some cases as even providing a stabilizing effect by inducing a more prudent national leadership once nuclear weapons have been acquired. In contrast, terrorists who gain access to a nuclear capability are considered more likely to use it.

In my personal opinion, we might be exaggerating the rationality—a slippery word—of states just as we exaggerate the irrationality of terrorists. States may launch or persist in diplomatic crusades or costly military adventures that the rest of the world may consider irrational. And groups that employ terrorist tactics may not always act irrationally. The larger groups in particular may be guided by a decisionmaking process that involves political calculations, reconciling different points of view, internal "bureaucratic" struggles, and other features inherent in national decisionmaking, not that these are in themselves any guarantee against "irrational" decisions.

That terrorists may not behave differently from states is significant in examining the possibility of terrorists wanting to acquire nuclear weapons in the first pace. The basic assumption of this colloquium, that by 1990 more than a dozen nations (in addition to the current six or seven) will have acquired nuclear weapons and that many others will be able to do so in a brief period, suggests a rapid acceleration in the pace of proliferation. In fact, it is about a five-fold increase in the rate of appearance of new nuclear states. It assumes that whatever constraints there are must have eroded badly. Nations for perceived reasons of national security—would this happen amidst wars?—diplomatic leverage, or national prestige, will have decided to acquire nuclear weapons. In some respects, it will resemble the "scramble for Africa," which occurred roughly a century ago, in which the possession of colonies for political, economic, or military reasons became an urgent necessity. Historians still debate the causes. In some cases, the stated reasons for acquisition seem to be justifications given after the fact. The scramble certainly generated some of its own momentum. So it may be with nuclear proliferation.

Plutonium stockpiles or avowed possession of nuclear weapons, even without sophisticated means of delivering them, may increasingly become the scepter of industrial progress and world power. This may be especailly true in the Third World where several of the more obvious proliferation candidates are. In that sense, China's progress from a guerrilla army to a nuclear power was inspirational. Modern terrorists could try to take a shortcut.

Terrorists emulate states. If a nuclear device becomes a widely-perceived symbol of state power, terrorists may be more inclined to go nuclear, or at least to carry out actions in a nuclear domain—for example, attacking or seizing nuclear reactors.* If this emphasis on symbolism seems heavy, it should be remembered that terrorist

* Nuclear programs have already become attractive targets for political dissidents and occasionally terrorists, not solely because of the danger they may pose to society or the environment but also because nuclear reactors have become symbols of the modern industrialized, capitalist state. Taking on nuclear programs is a means of taking on the "system."

actions are often heavily symbolic. The bombing of embassies, tourist offices, the Versailles Palace—often on anniversaries of significant past events—the seizure of the oil ministers of OPEC, the kidnapping of the former premier and probable future president of Italy, were all acts laden with symbolism. In this, terrorists, in their fashion, imitate national governments.* International diplomacy is loaded with symbolic actions—the dispatch of cruisers or carriers, overflights by jet fighters and other military maneuvers meant to send signals—warm embraces for some, sober handshakes for others at state visits, ambassadors summoned home for consultations—and symbolic language—"showing the flag."

Thus far, terrorists have not seen fit to kill or to threaten large numbers of people. They have achieved their aims of advertisement and coercion through actions which, although shocking and often murderous, have not directly imperiled hundreds or thousands. The largest hostage situations involve one hundred to several hundred persons (held hostage when Palestinians carried out a coordinated hijacking of several airliners in 1970), although in 1978, 24 members of a guerrilla group in Nicaragua briefly held over 1500 hostages when they seized the National Palace. Incidents of mass murder are relatively rare: 73 persons died in the 1976 crash of a Cubana Airliner jet that had been sabotaged by anti-Castro emigres; 88 persons died in the 1974 crash of a TWA airliner for which Palestinians claimed credit; 121 persons died in the 1978 bombing of an apartment building in Beirut; again in 1978 a deliberately set fire in a theater in Iran (allegedly by Moslem fanatics) killed over 400 persons.** Although, as mentioned earlier, these, along with the attempts to shoot down airliners with sophisticated hand-held missiles, may represent an escalatory trend.

The rarity of such incidents cannot be explained entirely by technical constraints, although the ease with which one can murder thousands has been exaggerated. There also seem to be self-imposed political constraints. Killing a lot of people, except perhaps for the genuine psychotic, is not an objective in itself. The capability to kill on a grand scale must be balanced against the fear of provoking widespread revulsion and alienating perceived constituents (a population which terrorists invariably overestimate), of provoking a massive government crackdown with public approval, of

* Without stretching the comparison too far, it is interesting to note a possible relationship between the development of national airlines and the increase in airline hijacking. The possession of a national air carrier with jet airliners became one of those necessary attributes of statehood in the 1960s. The national airliner was not simply a state-sponsored commercial enterprise; often it required continued government subsidy. Like the flag, it was another symbol of the nation. Terrorists could attack governments indirectly by attacking their airliners. And in hijacking an airliner, terrorists could demand, at least temporarily, to be treated as a state. Of course, an airliner is a convenient container of hostages that can be easily moved around the world, and the primary source of the hijackers' temporary power rests upon their explicit threat to harm the passengers. Nevertheless, the symbolic content is there.

** It is possible that the Beirut explosion was caused not by a bomb planted by one of the many factions in the Palestinian movement and aimed at another. Many of the apartment buildings in Beirut where Palestinian groups are headquartered also contain large arsenals of explosives. The devastating explosion might have been accidental. Neither are the details of the fire in Iran entirely clear. No group claimed credit for the event suggesting that constraints at least against claiming credit for mass murder may still prevail.

exposing the group itself to betrayal if terrorist group opinions on the political wisdom of mass murder are sharply divided. The groups most likely to have the resources, access to the requisite technical expertise, and the command and control structure necessary to undertake what for the terrorist groups is a large-scale operation are also those most likely to make such political calculations.

Using a nuclear capability to threaten instead of to kill outright also poses a number of problems. What can the terrorists demand? Threatening to kill thousands to spring a handful of prisoners seems out of balance. Impossible demands will not be met. Even under the threat of nuclear terrorism, a government is not likely to agree to liquidate itself. How long can the threat be maintained? If the terrorists are unwilling to dismantle the threat by surrendering the device, governments are less likely to yield. If the terrorists surrender the device, how do they enforce their demands, particularly if these are for such things as changes in policy? The "technical" problems of going nuclear are not confined to the acquisition of a nuclear capability.

On the other side of the argument, it is possible to imagine the arguments against nuclear terrorism being eroded in certain circumstances. Terrorists with more millennial visions and few perceived constituents this side of Armageddon might not worry about political calculations. A continuing terrorist campaign may have a brutalizing effect. A group may want to avenge its members who have been killed, or in some cases tortured. The imminence of defeat may call for desperate measures. Terrorists who recognize their cause as lost may be disposed to destroy what they cannot have or alter.

Terrorists who view their opponents as dehumanized because they are of a different skin color, language, religion, for example, might be less constrained to kill on a large scale. Or terrorists might not have a particular end use in mind when they acquire a nuclear capability, but once possessing a capability, they would be likely to find a use.*

A. Terrorists Could Use Nuclear Weapons in Several Ways

Although it is recognized that the immediate consequences of an event of nuclear terrorism will vary greatly according to the political circumstances of the specific act, it is not the author's intention to conjure detailed scenarios. The possibilities are too numerous. However, it may be useful to briefly explore how different terrorist groups

* Throughout this paper, we are discussing terrorists. It must be recognized, however, that there are other subnational actors who may come into the possession of nuclear weapons. One faction of a disintegrating government that already has nuclear weapons could seize the country's nuclear arsenal, or a political faction in a nuclear nation could seize and threaten to use nuclear weapons in a coup. The latter possibility has been explored by Lewis Dunn in "Military Politics, Nuclear Proliferation, and the 'Nuclear Coup d'Etat'," *Journal of Strategic Studies*, Vol. 1 (1), May 1978. Organized crime has also been mentioned as a possible nuclear actor in the future.

might use nuclear weapons.*

Terrorists could use nuclear "weapons" in several ways. Possession of a nuclear capability—a stolen nuclear weapon, a clandestinely fabricated device, or perhaps even a well-fabricated hoax—would give any terrorist group enormous publicity. It would not simply be another assassination, another kidnapping, another hijacking. It would put the first group to do it in an entirely new domain. Unlike nations, however, possession alone would bring terrorists little, except perhaps for the Palestinians. In their case, possession of a nuclear capability could alter political equations in the Middle East. It also could provide the Palestinians with psychological insurance against extinction. Nuclear powers do not disappear! But the Palestinians are unique in having a political apparatus, constituents, and international recognition and support to be able to derive political benefit from mere possession. Other groups would have to do something with their capability: use it or threaten to use it. (Conceivably, the Palestinians could also use a nuclear capability to prevent an imminent Middle East settlement or to provoke another Middle East war. This does not seem a likely employment by other groups.)

Most terrorist groups are likely to see a nuclear capability as an instrument of coercion. Those groups that have been frustrated in their efforts to release imprisoned comrades might threaten nuclear destruction to crack the resolve of governments that thus far have refused to yield when faced with the conventional hostage situations. They might at the same time demand multimillion dollar ransoms to offset their investment costs in acquiring their nuclear device and to finance future operations. Finally, they could demand a number of symbolic concessions—televised concession speeches by political leaders. The temptation to "jerk the government around a bit" just to demonstrate that they, the terrorists, were in charge might be irresistible.

Several terrorist groups—the IRA, for example—have shown little inclination for the kind of coercive terrorism seen in Latin America, the Middle East, or elsewhere in Europe. The IRA has not, with a couple of exceptions, kidnapped officials, hijacked airliners, or seized hostages in other ways. Perhaps because it perceives itself more as a military organization, its operations have had a more military quality. In the hands of

* There are a handful of currently active groups that, because of their financial resources, possession of the command and control necessary to coordinate a complex clandestine operation, possible access to persons with the requisite knowledge and skills to design and fabricate a nuclear device, demonstrated ability to accept risks and successfully carry out sophisticated tactical operations and, for some, possible foreign backing may be considered the most likely to carry out some kind of nuclear action, although this may not be the acquisition of a nuclear bomb. In the author's view, this group might include one or two of the Palestinian organizations, perhaps the Popular Front for the Liberation of Palestine, and Popular Front for the Liberation of Palestine General Command; two of the continental European groups, the Red Army Faction and the Red Brigades; the Irish Republican Army; and the Japanese Red Army. It is necessary to emphasize that this is by no means a prediction, nor is the identification of these groups based upon any specific intelligence information that these groups have taken any concrete steps toward acquiring a nuclear capability. It should also be emphasized that new groups or entirely new categories of adversaries not yet identified may emerge in the 1980s.

such a group, a nuclear capability might not be used as an instrument of coercion but rather in a more conventional manner by devastating a "military" target without prior negotiation.

Finally, one can conceive of a more emotional use of a nuclear capability as an instrument of punishment or as a "Doomsday Machine" by a terrorist group facing imminent defeat and the loss of all that they have fought to achieve or preserve. The historical model for this would be the final desperate acts of terrorism carried out and contemplated by the Secret Army Organization (OAS) in Algeria in 1962.

B. The Many Variables

There are several kinds of nuclear actions terrorists might take. What they do will affect the consequences. Terrorists could try to sabotage a nuclear facility such as a reactor, attempting to cause a core meltdown and radioactive release that might imperil the surrounding population, or they could seize control of a facility as they now seize control of government buildings, threatening to destory it (and themselves) if demands are not met. Terrorists could also try to obtain nuclear material for the clandestine fabrication of a nuclear explosive or dispersal device, or they could try to steal a nuclear weapon which they could then threaten to detonate if demands were not met. Or terrorists could fabricate alarming nuclear hoaxes intended to cause public panic.

Scenarios for an event of nuclear terrorism may include a relatively conservative postulation of a credible nuclear threat in an urban area which, when publicized, leads to some spontaneous evacuation, a few accidental deaths, perhaps some looting, but no nuclear device ever being found; an armed assault by terrorists on a nuclear weapons storage site leading to a brief loss of control of a weapon, possibly a detonation of the high explosive component of the weapon, with some contamination in the immediate area but no nuclear yield—the terrorists escaping without a weapon; and the revelation of a subnational plot to clandestinely fabricate a nuclear device the details of which are not publicized. All these conceivably might occur before 1990. Or one might postulate a more serious scenario involving the actual detonation by terrorists of a small crude nuclear device that produces casualties in the low thousands, still a small catastrophe compared with war or major natural disasters, but significant more because of its perpetrators than its scale. It should be noted that even this scenario is well short of the nuclear disasters depicted in many recent novels of nuclear terrorism and some of the more lurid journalistic offerings.

There are many variables associated with scenarios of nuclear terrorism leading to innumerable combinations. Whether the nuclear device used by the terrorists is a stolen weapon whose built-in safeguards they have somehow managed to circumvent,

or a nuclear device which they have clandestinely fabricated, will be of major importance. In the former case, determining the original owner of the weapon would make a great difference. Was the weapon known to be stolen? Did the government losing the weapon publicly admit the theft? Was there evidence of collusion between elements of that government and the terrorists? In the case of a clandestinely fabricated device, where did the nuclear material come from: a weapons program or an energy program? Was it acquired by overt theft, corruption of officials, or through second parties? Answers to these questions would affect not only the immediate political consequences of the act but also the measures seen necessary to prevent a recurrence.

Where terrorists have used a nuclear weapon as an instrument of coercion, it is likely that the detonation would be accompanied by both prior warning and demands, although it is possible, albeit somewhat more remote, that a detonation could take place without demands as a means of establishing credibility for a threatened second detonation which would be accompanied by demands. It is also possible that a premature or accidental detonation could take place, disrupting the terrorist plans.

If we assume a detonation after demands have been made, then we may logically assume that the demands have not been met. It would then be necessary to postulate upon whom the demands have been made: the government of the country which is targeted, another government, or several governments? Prior warning, of time but not place, could be used as a means of creating great disruption in addition to any damage done. Since the genuine threat when publicized is likely to inspire several phony nuclear threats, this disruption would be widespread.

The nature of the demands would be an important variable. We presume that the resources required to acquire a nuclear capability suggest a well-organized, well-financed group and, hence, that any demands made would be rational. There is the outside possibility of totally bizarre demands but these are more likely to be associated with individual lunatics and tiny groups on the psychopathic fringe, hence presumably lacking the resources to acquire a nuclear capability. Does it appear that the authors of the threat would prefer to use the device? And does the government negotiate? This is extremely important for in many previous incidents of terrorism where governments refused to negotiate and hostages were killed, we note a curious displacement of culpability. Often the government as much as the terrorists was blamed for the tragic result.

The degree of perceived government collusion in the act of nuclear terrorism will be extremely important. There will be a tendency, whatever the evidence, to see the hand of some government in the act. It is a tendency we note now in major incidents

of terrorism. The display of tactical skill in the kidnapping of Aldo Moro, for example, aroused Italian suspicions of foreign involvement. Rumors suggested participation by both the CIA and KGB. We note a similar difficulty in accepting the assassination of major political leaders as the act of one person. Conspiracy theories have a powerful attraction in malevolent acts of great magnitude. Unless technological developments between now and 1990 will have made the acquisition of weapons quality material much easier than it is now, it will be hard for many to accept that terrorists were able to acquire the material and build a bomb by themselves. We have heard many arguments that it is simply too difficult. And, as some comfort is derived from this belief—it is better to think that only governments and not just any band of political fanatics working alone can do this—one can foresee an inherent desire to see things that way if an incident occurs.

The yield and location of the device will greatly affect the consequences. The yield of the device in turn will depend on the quality of the design and the amount and nature of the nuclear material used (highly enriched uranium, reactor grade plutonium, weapons grade plutonium). The bomb dropped on Hiroshima was estimated to have a yield of 13 kilotons, that used at Nagasaki, a yield of 23 kilotons. The Indian nuclear explosion was in the 5 to 10 kiloton range. Recognizing that all such estimates are necessarily speculative, those who have discussed the matter with the author estimate the yield of a crude, clandestinely constructed nuclear device would probably be in the tenths of a kiloton range.

The effects of a blast of this size would depend on where it went off. The worst possible case would involve a detonation in the middle of a major city like New York where population densities may run as high as 100,000 persons per square mile. A one-to-six-tenths of a kiloton device detonated there would level everything within a 600-ft radius and cause severe damage beyond. From 10,000 to 20,000 people could be killed by the blast. Another 50,000 would die from immediate radiation which would extend out to 2,000 feet from the point of detonation. Approximately 20,000 would be seriously ill (incapacitated) but not killed by the radiation effect. This gives a total of 60,000 to 70,000 dead, about equal to the number of persons who were killed in Nagasaki. In a city less densely populated, for example, the populated portions of Los Angeles County, the casualties also would be considerably less. A similar size bomb might produce 6,000 to 7,000 casualties.

There is no precedent outside of war for a single incident with casualties in the range mentioned for a hypothetical detonation in a city as densely populated as New York. The only historical equivalents are natural disasters. Some massive earthquakes and floods or tidal waves in heavily populated areas have killed tens of thousands. There have been only about five earthquakes in the twentieth century with casualties

of this scale. The median earthquake of the major twentieth century earthquakes killed about 6,000 persons. In those cases, the casualties are scattered over a wide radius. A few major dam breaks have killed in the low thousands. The worse shipwrecks have resulted in as many as 1,000 to 1,500 deaths; the worst fires, 500 to 1,500 dead, and the worst peacetime explosions (outside of coal mines), our closest physical analog, have killed from 300 to 1,500 persons. For example, 1,500 persons were killed on December 6, 1917, in Halifax, Canada, when a ship loaded with ammunition collided with another vessel. An explosion in 1956 involving seven trucks loaded with ammunition killed 1,100 persons in Colombia. The explosion of a ship loaded with fertilizer killed 516 persons in Texas City, Texas, in 1947.

It is not simply the number of casualties that will affect the world's perceptions of the incident but also where they occur. An incident that occurs in Asia, Africa, or Latin America is likely to be less shocking (at least to the North Atlantic population) than one that occurs in Western Europe or North America. We are more accustomed to immense natural disasters with great loss of life in the so-called Third World. We also have a greater expectance of political violence in the Third World. A nuclear explosion in Pakistan or in the Middle East would conform to the perception of these nations as being wild countries, would set tongues clicking, but would not have the impact of a similar detonation in Paris or London. An explosion in the Soviet Union or China is likely to have less impact because both the blast and the consequences are likely to be shrouded in secrecy. On the other hand, a nuclear explosion in a Western nation would provoke tremendous media coverage and investigation.

Timing is important, too, although perhaps not as important as location. An explosion that occurs in the midst of a civil war, for example, during some future equivalent of the Spanish Civil War, or intense fighting in Beirut, will have somewhat less impact through the media than an explosion in a less turbulent environment. The presence or absence of large-scale warfare in other parts of the globe that may distract public attention from focusing for a length of time on a single nuclear incident would also have an effect.

IV. THE CONSEQUENCES

We presume now in our discussion that an act of nuclear terrorism has occurred. The immediate political consequences of that act would depend on the political circumstances in which the incident occurred, plus the other variables mentioned. These are extremely difficult to predict. As mentioned before, it would make a great difference whether Palestinian terrorists threatened to blow up Tel Aviv or West German terrorists grabbed an American nuclear weapon in Europe.

There are, however, broader consequences that would derive from the simple fact that a group outside any government (although perhaps with government help—a terrorist group—had acquired and threatened, credibly, to use or actually detonated a nuclear device. The immediate assumption would be that it could happen again, indeed would happen again unless preventive measures were taken, that the consequences would be equally as bad, or if the detonation was not particularly destructive, that the consequences would be worse the next time, therefore that the terrorists, any terrorists, must be stopped.

A. Increased Security at all Nuclear Facilities

The first obvious consequence would be the increase of security at nuclear facilities everywhere. It might make some difference whether the device used by terrorists was a stolen nuclear weapon or an explosive device clandestinely fabricated by terrorists. In the former case, some might argue against unreasonable increases in security at civilian nuclear facilities as unwarranted. But this argument would be considerably weakened by the terrorist event. The detonation of a stolen nuclear weapon would undermine confidence in physical security measures and in the protective technology (assuming that everyone's nuclear weapons had some permissive action link that destroys the weapons if it is tampered with). It might bring about increased concern on the part of governments of countries that are hosts to others' nuclear weapons. For example, the detonation of an American nuclear weapon stolen in Europe, or even the successful theft of a nuclear weapon in the United States could bring about increased pressure to remove all American nuclear weapons from Europe. To counter such arguments, security would have to be visibly improved.

If it turned out that the device had been fabricated with material removed from civilian nuclear programs, increased security measures would be imposed across the board. Initial security measures at both civilian and military nuclear facilities could take the form of troop deployments like those around vital defense industries in wartime. In most Western nations, the troops would be seen as a temporary measure, permitted by hastily implemented legislation until a permanent guard force would replace them. Guarding nuclear facilities would probably be taken out of private hands. The cost of nuclear energy would not be significantly altered by the added security costs. Depending again on exactly how the terrorists acquired the material used in the bomb, increased security measures would also extend to the employees, particularly those having access to material and those with the expertise to design and build nuclear weapons. This would entail the wider application of background checks, more rigorous investigations, and closer monitoring of employees in sensitive positions or having special skills.

Finally, governments would be compelled to consider procedures they might follow after a theft of nuclear material or of a nuclear weapon has occurred, or after a credible nuclear threat has been made. Presently, far less attention is paid to this area than to preventive measures. More attention would have to be devoted to contingency planning for search and recovery and to the possibility of predeployment of nuclear search equipment and teams of operators. Governments would have to give advance consideration to the kinds of restrictive legal measures that might have to be imposed temporarily to deal with a nuclear threat.

The real possibility of nuclear terrorism would also raise basic policy questions. Governments would be compelled to reexamine current no-negotiations or no-concessions policies. These policies were originally formulated in cases where the terrorists' ability to kill hostages was clearly limited. In case of credible nuclear threats, governments might have to abandon the perception of the event as a zero-sum game with no middle outcome. Negotiations and limited concessions might be considered necessary if only as a means of delaying any action while gaining information about the terrorists.

Finally, more attention also would have to be given to the requirements of decontamination and normalization. Such problems, of course, arise in nuclear war, too, but in a wartime environment they may be of secondary importance to national survival, whereas in the case of a small peacetime nuclear explosion set off by terrorists, prompt treatment of any civilian casualties and rapid decontamination and restoration of property might be a test of government competence and a prerequisite of its political survival.

B. Crackdown on all Dissidents

Governments everywhere would be likely to become a bit more repressive in an age of nuclear terrorism. Known terrorist groups and political dissidents would be the target of crackdowns whether or not they were in any way connected to the nuclear terrorists, espoused similar causes, or were believed to have the same capabilities to acquire nuclear material, design and fabricate a nuclear weapon. In some cases, the crackdown would be motivated by genuine fear, however remote, of further acts of nuclear terrorism. In other cases, the act of nuclear terrorism might be an excuse for declaring war on anti-government dissidents.

Special legislation similar to that in the Atomic Energy Act of 1954 and the later amendment might be introduced prescribing stronger penalties for unauthorized possession of nuclear material, nuclear extortion, etc. Since society cannot afford to await the commission of a nuclear crime, efforts will be made to move back the